









## NYU ABU DHABI UNDERGRADUATE RESEARCH



NESPONONS LOCALLY TO GLOBAL PRODU
In the production of the local production

جامعـة نيويورك أبوظـي

NYU ABU DHABI

## NYU ABU DHABI UNDERGRADUATE RESEARCH

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Research is an integral part of an NYU Abu Dhabi education and undergraduate students have the opportunity to participate in research projects alongside world-class faculty and researchers throughout the academic year and summer, via various programs administered by the Office of Undergraduate Research. Each summer, students are able to take part in full-time research, either by independently taking on their own research projects, or by assisting faculty with existing research projects. Supervising faculty may be part of the NYU network, or external faculty who are leaders in their fields. Research opportunities span the disciplines, and examples of undergraduate research projects are as far ranging as working on population genetics of marine species in Arabia, to a study on forest policies of southeast Asian rail and road projects, or applying algorithms to economic theory.

I would like to thank all faculty and academics involved with supervising NYU Abu Dhabi undergraduate students, and allowing them the opportunity to hone their research skills by becoming active investigators, who demonstrate creativity and learn the ability to tackle new and exciting challenges.

Our students have shown their thirst for knowledge and an eagerness to push academic boundaries. Their research and creative works have in turn led to publications in world-leading journals and presentations at prestigious conferences across the world. The abstracts and research projects published here are testimony to this, and represent some of the excellent research and creative work undertaken by undergraduate students in 2019.

This year saw the Research Fellowship Program come to fruition, whereby a select cohort of exceptional NYUAD graduating seniors with a demonstrated interest in academia were awarded a prestigious one-year research fellowship at NYUAD. Within this publication, you will find information about the research projects of the selected fellows, and we are confident of their contributions to the growth and development of research in the UAE.

A special thank you and appreciation is extended to the Office of Undergraduate Research Faculty Committee, who advise on the office's programs, guidelines and new initiatives, and review in excess of 120 conference and summer research grant applications each year. The Committee comprises:

• Andrea Valerio Macciò Associate Professor and Program Head of Physics

• Nelida Fuccaro Associate Dean of Humanities, Professor of Middle Eastern

History

• Olivier Bochet Associate Professor of Economics

• **Pradeep George** Senior Lecturer and Coordinator of Engineering Capstone

Design Projects

I would also like to extend my gratitude to Vice Provost and Associate Vice Chancellor of Global Education and Outreach Carol Brandt, who oversees the development of NYUAD's summer programs of experiential learning, serving more than 500 students in internships and undergraduate research in over 30 countries. Finally, I would like to acknowledge and thank Assistant Director of the Office of Undergraduate Research Farhana Goha, for her work over the years in overseeing and developing the programs within the office.

#### Nada Messaikeh

Associate Vice Provost, Research Administration and Financial Planning



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# OVERVIEW OF UNDERGRADUATE RESEARCH PROGRAMS



## SUMMER UNDERGRADUATE RESEARCH PROGRAM

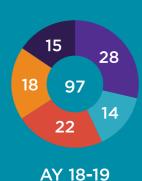
The NYUAD Summer Undergraduate Research Program offers competitive grants to support students across the divisions, who have secured summer research positions. Students may work on independent research projects or join existing faculty research projects.





## POST-GRADUATION PRACTICAL TRAINING PROGRAM

The Post-graduation Practical Training Program (PPTP) allows faculty to appoint NYUAD seniors graduating in May to work full-time on faculty research projects in the summer following their graduation.



- Art and Humanities
- Engineering
- Science
- Social Science
- Administrative Projects

O 7 POSITION

## VISITING UNDERGRADUATE RESEARCH PROGRAM

This competitive program offers the opportunity for NYU New York, NYU Shanghai, and external undergraduate students currently studying in local universities within the UAE to take part in research during the summer, supervised by NYUAD faculty members and funded by the Office of Undergraduate Research.



- No. of positions secured
- No. of students applied

7 POSITIONS IN THE UAE

#### **CONFERENCE PRESENTATIONS**

The NYUAD Undergraduate Research Program offers competitive conference grants to enable students to present their research work in prestigious conferences and at other venues where they can showcase their research and creative activities.



- Art and Humanities
- Engineering
- Science
- Social Science

AY 18-19

23 PRESENTATIONS IN 15 COUNTRIES



As an institution that makes an equal commitment to undergraduate liberal arts education and to cutting-edge research in the arts, engineering, the humanities, and the natural and social sciences, NYU Abu Dhabi makes it a priority to provide advanced research opportunities to its undergraduate students.



## SUMMER UNDERGRADUATE RESEARCH HIGHLIGHTS



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#### UGR

Class of 2021 | Major Social Research and Public Policy and Theater Faculty Supervisor Rubén Polendo



## THEATER MITU'S SOUTH INDIA ARTIST INTENSIVE

This summer, I participated in Theater Mitu's South India Artist Intensive. I was involved in academic, dramaturgical, and aesthetic research in South India. The intensive explored the role of the artist as a researcher. The exceptional thing about research in and through art is that practical action — the making — and theoretical reflection — the thinking — go hand in hand. The one cannot exist without the other, in the same way action and thought are inextricably linked in artistic practice. This is the reason why the artist intensive utilized physical training and hands-on engagement with classical Indian art forms and techniques. Reflection and research were closely interwoven with artistic practice.

Participation in this project gave me the opportunity to access Theater Mitu's core research, training, laboratory, and creation methodologies, known as Whole Theater. The investigation/research happened at different levels. I engaged in physical training on a daily basis in various South Indian art forms and techniques such as Kalaripayattu, Mohiniattam, Kathakali, and Yakshagana.

I had panel discussions and participated in seminars with local Indian artists, lawyers, activists, and scholars. By doing so, I explored the role of international dialogue in formation of new creative artistic methodologies. To trace back the role of mythology and spirituality in performative practices, I visited several places of worship for Hindus, Jains, Muslims and Sikhs. I helped fulfill Theater Mitu's mission to fuel the experimentation and expansion of theatrical form. As a dancer and a theater practitioner, I used my own body as a tool to engage with various classical Indian arts. I was able to describe firsthand the impact these art forms and techniques had on my body and mind.





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#### JULIÁN GUTIÉRREZ **CARRERA**



UGR

Class of 2020 | Major Literature and Creative Writing Faculty Supervisor Cyrus R.K. Patell

#### SHAKESPEARE IN THE MIDDLE EAST AND NORTH AFRICA

My summer research focused on how the spread of the digital humanities enables an understanding of Shakespeare beyond the page or performances. Through the use of information technologies, it is not only possible to map the movement of physical copies of the scripts, but also to map performances and track changes in them. The biggest takeaway, however, is to track how translations into different languages have altered the text. Thus, the project puts together multiple translations of Shakespeare's works and re-translates the translations into simple English to track what changed.

#### CYRUS R.K. PATELL

Global Network Professor of Literature, NYU Abu Dhabi; Professor of English, NYU New York

Working with faculty members who have longstanding commitments to research and scholarship, undergraduates in my field of Literature and Creative Writing produce Capstone projects that use in-depth research to make valuable contributions to professional scholarship in the field or that draw on scholarly research to produce imaginative works that are fully engaged with global literary cultures. For these students, the summer before senior year is a a crucial time to conduct research in order to develop their Capstone topics in ways that enable them to make significant interventions in their fields, whether they be scholarly or creative, and the support for summer research that NYUAD provides has proven to be crucial to the success of these projects. In addition, for the past three summers students in Literature and other fields have been able to work on the Global Shakespeare Project, funded by the University's Research Enhancement Fund, to conduct research on the global spread of Shakespeare's texts and the creation of global cultural heritage; to learn techniques used by archivists in the University's Special Collections; and to acquire skills used by digital designers and scholars in the digital humanities. Summer research has indeed proven to be a strength of NYUAD's programs in the arts and humanities.



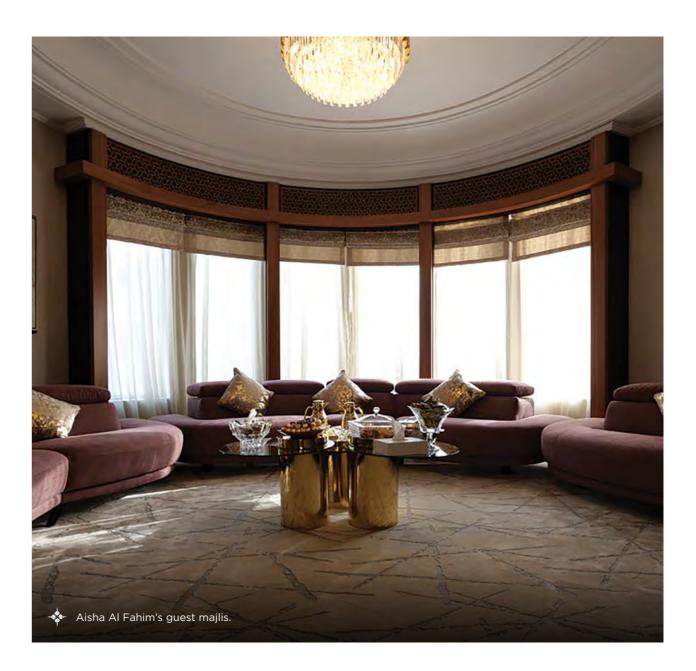


Class of 2020 | Major Literature and Creative Writing Faculty Supervisor Cyrus R.K. Patell

#### "DEATH IS A PERFECTION OF THE EYE": BLACKNESS IN TEJU COLE'S OPEN CITY AND EVERY DAY IS FOR THE THIEF

Julius, the narrator of Teju Cole's two novels, Open City (2011) and Every Day Is For The Thief (2007), is black: he is Nigerian, born to a German mother. Julius is affected by his race; he does not want to think of himself as black, he shies away from claims of his African origin, and is estranged from his mother and from Nigeria.

Reading Cole's novels as deeply invested in the notion of blackness, I wanted to ask in this research project; what does it mean that Julius is black? How does blackness function to enable or inhibit Julius's cosmopolitanism? What, ultimately, should we learn from the series of collisions between history, race, art, nationhood, Africanism, blackness, and cosmopolitanism that constitute Cole's novels? At the School of Criticism and Theory at Cornell University, I refined these questions and constructed a theoretical framework around my project in a seminar called "Black Life" taught by Alexander Weheliye.



Class of 2022 | Major Film and New Media | Faculty Supervisor Joanna Settle

#### AN EXPLORATION OF THE MAJLIS

This investigation was guided by a desire to understand the cultural, social, and political role of the majlis in the UAE. Although my research began with an attempt at using academic sources, these proved to be quite limited. The most valuable portion of the investigation was thus a series of interviews conducted in person, through phone calls, and by email. Many Emirati men and women were kind enough to invite us into their own majlis. In these spaces many topics arose, some of the most relevant include: old and new traditions, men and women majlis, oral storytelling, the politics of the mailis, treatment of guests, holidays, and the different kinds of majlis. Although the research was compiled into a video for sharing purposes, the source material will be used to create a theater piece next semester. My hope is that it will authentically capture the wonderful values shared in a majlis.







ART AND HUMANITIES ART AND HUMANITIES 19







UGR
Class of 2020 | Major Theater | Faculty Supervisor Tomi Tsunoda

## EXPLORING PARTICIPATION IN THE THEATER

I developed a Student Lead Project under NYUAD's Theater Program, which will culminate in a final showcase at the start of the fall semester. Each week I delved into a different form that I find to be related to participation in theater, which is my main interest as an artist. The delving consisted of textual research and creative explorations of my own and the aim was to make a short piece every week that will be showcased to a guest audience, and then move on to the next form. This was not only a way for me to take a deep dive into the work I am interested in pursuing as an artist, but it was also a way for me to discover my individual artistic process outside of the context of a class assignment. I also took this opportunity to develop a way of documenting my work, both for portfolio showcases and for my own self-reflection.

UGR

Class of 2020 | Major Theater and Economics | Faculty Supervisor Leon Ingulsrud

#### **OUR MINDS IN MOVEMENT**

The summer Intensive involved an in-depth exploration of Viewpoints training and the Suzuki Method of Actor Training, in a month-long conservatory styled setting. Instruction was provided by established members of SITI Company, including Anne Bogart, Ellen Lauren, and Leon Ingulsrud.

Additional research focuses included: speaking training, dramaturgy class, developmental movement work, and composition.

This summer's composition work focused on Chekhov's Three Sisters; the play was split into nine segments among the 54 intensive participants. I performed in one segment and served as the movement director for a second.







UGR
Class of 2020 | Major History | Faculty Supervisor Erin Pettigrew

## TRANSNATIONAL IDENTITIES AND MODES OF SELF-IDENTIFICATION: THE LEVANTINE COMMUNITY'S NAVIGATION OF IMMIGRATION POLICIES IN 1920S MEXICO

This Capstone project explored the intersection of politics, economic anxieties and national identity formation that defined the Levantine migrant experience in Mexico. The research undertaken focused on the 1920s as a period during which the Mexican state attempted to codify national identity and to limit immigration. This was also a period of economic, cultural and political institutionalization for members of the Levantine community of Mexico. Through research in French and Mexican diplomatic, colonial, and national archives, this project addressed the impact such policies on modes of self-identification among immigrants from the Levant. This project is in conversation with scholarship on the Middle East and Latin America and seeks to emphasize connections between political and sociocultural history as part of the expanding field of migration studies.





#### **CHRISTOS PLACHOURAS**



Class of 2021 | Major Computer Science and Music | Faculty Supervisor Carlos Guedes

#### COMPUTATIONAL AUDIO ANALYSIS FOR ETHNOMUSICOLOGY

The research work involved the development of methods based on digital signal processing and machine learning to define content-based measures of similarity between music pieces. The purpose was to leverage low-level musical features extracted from the signal of the music pieces in order to visually represent structures and clusters of similar pieces from music datasets and libraries in an organized manner, and map those features to higher-level, perceivable musical features.

The work also extended to the applications of music dataset indexing and labeling in the context of cultural heritage preservation, and especially in our dataset of Swahili coast and Arab Mashriq music. An interactive interface with visualizations and auditory feedback was developed, with the aim to convey content-based feature similarity in an intuitive and accurate way by experimenting with insights from psychoacoustics and user interface design.





Major Political Science | Faculty Supervisor Pedro Monaville

#### THE AFRICAN COLD WAR UNIVERSITY

I provided research assistance to Professor Monaville, helping him research the history of higher education in Africa at the time of the cold war. I conducted bibliographic research on the history of cold war campus culture and American support to African universities. I wrote research notes for Professor Monaville based on close readings of academic articles and monographs relevant for his research project. I also spent a big part of the program browsing through reports, letters and other archival documents, in both French and English, with the most important collections being archives of the Ford and Rockefeller foundations and of the international bureau of the United States National Student Association.

This research will result in a journal article authored by Professor Monaville that will address the impact of the cold war on university campuses in Congo/Zaire in the 1970s. An important question in the article will be to understand the dynamics in the relations among the US government, American foundations, expatriate academics, Congolese students, and the Congolese state. The article builds on Professor Monaville's current book project, which focuses on the role of Congolese students in the process of decolonization in the 1950s and 1960s.





UGR

Class of 2020 | Major Arab Crossroads Studies Faculty Supervisor Deborah Kapchan

#### ACROSS TIME AND SPACE: "GLOCALISM" AT THE SHARJAH BIENNIAL

Art has long served as a platform for cultural exploration, representation, and exchange, particularly in the space of international art fairs (Althuser 2008; Kirshenblatt-Gimblatt 2007).

How does the Sharjah Biennial in the United Arab Emirates use (or ignore) local identity while curating an event that speaks to internationally relevant concerns? In this research, I employed ethnographic and archival research methods to explore this question at the Shariah Biennial. I argued that by hosting and commissioning artworks from international artists, the Sharjah Biennial addresses international concerns in a local setting. Drawing upon the theoretical framework of the "glocal"—both global and local (Bauman 2014)—this research filled a lacuna in museum and cultural studies by focusing on the rapidly materializing art markets in the Gulf, while contributing a valuable and detailed case study of the Sharjah Biennial to extant literature on international biennials.

Major Political Science | Faculty Supervisor Shamoon Zamir



#### ARCHIVAL RESEARCH: KRIKORIAN FAMILY COLLECTION

My work focused on archival research using a series of photographs of the Krikorian family from the Syrian collection of Akkasah Center for Photography. Having very little information about the family portrayed in the photographs, my research aimed to reveal information about the family history, as well as examine the broader theme of studio photography in the Middle East.

Furthermore, using secondary resources varying from essays to interviews, I explored the significant contribution of the Armenian diaspora to the development of photography in Syria, Lebanon, and Egypt. While not specifically aiming to reach out to the descendants of those in the photographs, one of the outcomes of the research was identifying the potential relatives of the Krikorian family. My PPTP experience was a great example of how archival research works in practice and allowed me to better understand the difference between narrative construction and factual research using the limited and yet valuable information gathered form photographs.

Major History and Economics | Faculty Supervisor Nelida Fuccaro

#### HISTORY OF THE MIDDLE FAST OIL INDUSTRY

This research project began during the academic year and continued into summer. Looking at 10 years' worth of research around the world on the history of the Middle East oil industry, this project involved creating a system of filing and tagging a variety of materials from archival files, photographs, newspapers, magazines, official publications, technical reports, and memoirs. This has contributed to the creation of a unique repository on information while honing my IT and organizational skills.







#### **NELIDA FUCCARO**

Associate Dean of Humanities; Professor of Middle Eastern History, NYU Abu Dhabi

PPTP: A unique experience for recently graduated students in a coursework, exam and Capstone free environment. This intensive summer research program helps students to hone further key research skills, organizational competencies and creative talents in preparation for postgraduate study, or work.

My student assistant has planned, designed, and organized from scratch a searchable data set containing a variety of materials on the history of the oil industry in the Middle East that I have collected over the years. She has handled with great skill and sensitivity precious primary sources, including digital copies of rare newspapers and photographic collections, and other written, visual, and oral materials, often in different languages (especially Arabic). Exposure to sources of this kind, and the breadth and depth of engagement with them that this research program has made possible is an essential part of the toolkit of any professional historian working on the Middle East, South Asia, and Indian Ocean World.



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#### **ADAM NAGY**



Major Film and New Media | Faculty Supervisor Craig Protzel

#### 24X DOCUMENTARY

I worked on editing a documentary video for the Interactive Media event, 24X. During this event, five student pairs come together to collaborate on a joint project for 24 hours, to create something meaningful. This embodies the ethos of the Interactive Media program which fosters "4 C's": creativity, collaboration, communication, and critical thinking.

I worked with documentation footage that was recorded over the course of four years. From the recorded eight hours of footage our goal was to edit a video that is 8-10 minutes long. Collaborating closely with Professor Craig Protzel we were able to come up with a direction for the project. Through the video we were able to convey not only how the students work through the event, but how it feels like to be there - inspirational, playful, stressed.



Burlin, Alexander. "Empowerment through Development? Towards a Political Critique of the 'Jordan Compact'." Oxford Monitor of Forced Migration 8, no. 1 (2019).



Major Art and Art History | Faculty Supervisor Sarah Fay Krom

#### TOWARDS A VISUAL LANGUAGE FOR INTERACTIVE STORYTELLING

This research served to inform the visual style of Professor Sarah Krom's 2D sidescroller game, Grasp. Grasp is a game that explores seeing in games. It is focused on perception rather than action. I researched how a set of game mechanics, based the language of filmic storytelling, where the player controls the camera rather than the game's protagonist, could work and look. Together with my colleague, Shantanu, I worked on a mini game that explores this.



#### **SARAH FAY KROM**

Assistant Professor of Practice of Interactive Media

This area of research in interactive storytelling is very much grounded in a knowing-by-making process. As a nascent form of visual media with substantial room for exploration, the student researchers were instrumental in contributing their notions of the possibility space and experimenting with different approaches and visual styles for the prototype. The time spent building the prototype gave us valuable insight into some of the features that are truly distinct to this form of storytelling.

Class of 2021 | Major Arab Crossroads Studies | Faculty Supervisor Nora Barakat

#### STUDYING ADVANCED MODERN STANDARD ARABIC AND OMANI DIALECT IN IBRI

The goal of this program was to increase my Arabic proficiency in both Modern Standard Arabic and in the Omani dialect while also familiarizing myself with the culture. To do this I lived and studied in Ibri, Oman, at the crossroads of the Empty Quarter and the populated portion of Oman, at the intersection of the road from the UAE to Oman, and Oman to Mecca. While the duration of the classroom knowledge took place in Ibri, the extracurricular learning took place throughout Oman. From the beaches of Salalah, to the peaks of the Hajar mountains, I attempted to absorb as much as I could from the culture and language, and this will act as a great base for my Capstone work.





Major Political Science | Faculty Supervisor Miguel Syjuco

#### USAPANG ATIN PROJECT

The Usapang Atin project, meaning Our Conversation in Tagalog, is a platform where anyone and everyone regardless of race, religion, political alignment, or beliefs could come together to engage in civil conversation.

The project aimed to develop an initiative to create scalable models for autonomous, community-based discussions focusing on civics, citizen participation, and group dynamics. This text-based conversation framework promoted community engagement and provided solutions or compromises to contentious issues that the modules provide. It included story sharing, self-teaching modules and relationship building exercises that prioritize civil discourse. This project showed the power of conversation and how we as humans have a role to play in each other's lives.







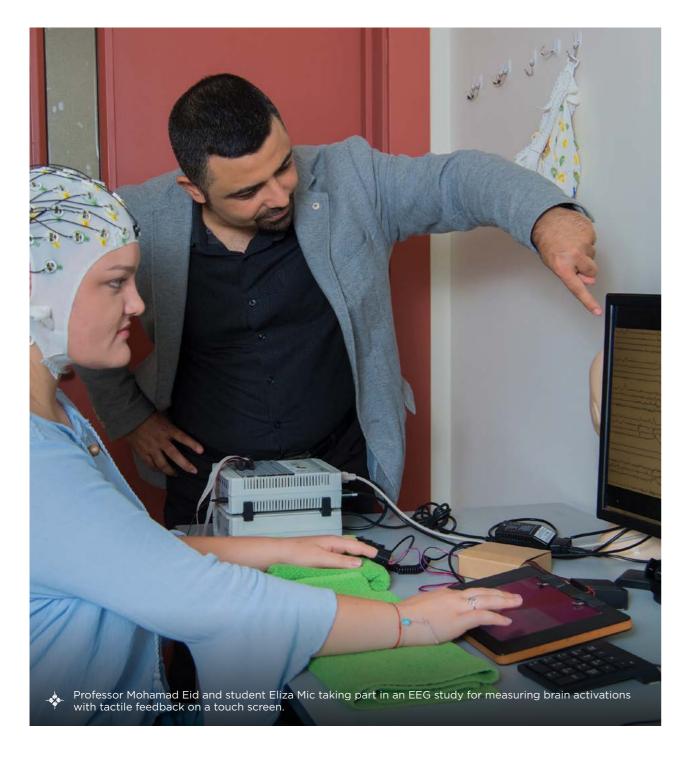


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#### **MOHAMAD EID**

Assistant Professor of Electrical and Computer Engineering; Principal Investigator, Applied Interactiv Multimedia (AIM) Lab, NYU Abu Dhabi

The Applied Interactive Multimedia (AIM) research lab investigates the development of haptics technologies to simulate the sense of touch for various applications such as handwriting and medical training, interpersonal communication, and tele-robotics. Having undergraduate students in our lab is great for developing software/hardware and running psychophysical experiments. The students also inspired our researchers to collaborate and interact with younger colleagues, and provided a fresh perspective to address research questions in various ways.



#### PPTP

Major Electrical Engineering | Faculty Supervisor Mohamad Eid

#### HENOK GULUMA

#### HAPTODONT SIMULATION PROJECT

This project aimed to build a haptodont simulation guidance system that can serve as an educational tool for dental students. The main motivation behind the project was to bridge the gap between practical training provided for dental students and application of their knowledge in real life patients. In other words, this prototype tries to present dental students with a realistic experience of real-life dental procedures before they start to practice on real human beings. It is also believed that such simulations make the learning process of practical lessons much easier and faster, hence efficient. The prototype makes use of haptic devices, which are devices that provide haptic feedback using vibrotactile cues, and Oculus rift virtual reality kit.

The initial goal and main focus of the project was to create a step-by-step guidance system to help the student achieve the proper way to carry out dental probing. In dental probing, the four main steps include: initial adaptation, angulation, insertion, and activation, which is the constant smooth walking of the probe to detect pockets in the human gengiva. The student is supposed to follow these steps each time the procedure is being carried out. The process needs to be precise; hence the guidance system also needs to operate in extreme precision so that the student achieves such precision. The final guidance system, built using software CHAI3D, constitutes of a module to record a session and another module to playback a recorded session. This way, a dental professor or trainer can record a typical probing session and the dental student can playback this session, with the help of a haptic feedback, to follow and replicate the session and learn the steps properly.





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KEN **IIYOSHI** 

Class of 2020 | Major Computer Engineering | Faculty Supervisor Mohamad Eid

**MAHRUKH TAUSEEF** 

Class of 2020 | Major Electrical Engineering | Faculty Supervisor Mohamad Eid

RUTH **GEBREMEDHIN** 

UGR

Class of 2020 | Major Electrical Engineering | Faculty Supervisor Mohamad Eid

#### ROBOTIC ARM TELE-OPERATION USING HAPTIC **EXOSKEL FTON**

Tele-operation allows the accessibility and manipulation of remote environments. For this project, a tele-operation system was developed to communicate haptic and audio-visual data between local and remote operators. The communication of haptic data will improve the perception of remote environment as it adds a sense of touch. This system consists of three elements. It enables a synchronized communication of haptic, audio, and visual data to form a multi-modal tele-operation. To control a remote KUKA Robotic Arm, a full exoskeleton was developed for vibrotactile feedback. This involved the design of the hardware circuitry for controlling a number of vibrotactile motors, a software to implement an algorithm for apparent tactile motion, and the 3D reconstruction of the remote environment. The developed system will be evaluated in a real-life tele-operation application where a robotic arm is remotely controlled by a human. Such a system has extensive applications in telesurgery, rescue, construction, and service.



Major Civil Engineering | Faculty Supervisor Borja García de Soto

#### **RAITIS PEKUSS**

#### PRODUCTIVITY ANALYSIS OF CONSTRUCTION PROJECTS USING 3D PRINTING

3D concrete printing (3Dcp) has the potential to improve productivity in the construction industry, which despite its significant impact on the global economy has reported stagnating growth in productivity. One reason for this is the reluctance to implement new technologies in the construction sector, ranking it as one of the least digitized industries. This research attempts to provide an argument for implementing 3D printing in the construction industry as a means to cutting costs and time.

Two simulations were created using Cyclone, a discrete event simulator, for comparing construction projects that incorporate 3Dcp and similar projects that use conventional construction methods. The inputs for these simulations were estimated and obtained from the RSMeans guidebook

To gain more insight about the industry, I attended an additive manufacturing conference in Dubai as well as the inauguration of a 3D printing facility operated by Concreative, a Dubai based 3Dcp company. These meetings have resulted in potential collaborations, useful for future research that I will continue as an NYUAD Research Fellow.



Major Electrical Engineering

Faculty Supervisors Borja García de Soto and Hoda Alkhzaimi

#### APPLICATION OF BLOCKCHAIN TO CONSTRUCTION SUPPLY CHAIN: REVIEW AND CASE STUDY WITH THREAT MODEL ANALYSIS

The construction industry has been the main driver of economic growth for many countries. Multiple times, it has been cited as one of the world's most fragmented and high-impacted industries. However, it has also been reported as one of the most stagnant major industries in terms of productivity and innovation, according to a 2017 McKinsey report; a result of lack of technology investment and fragmentation. Large-scale projects like the Burj Khalifa have illustrated the fact that there is a lack of accountability, and a high need for transparency and traceability of payments in the construction industry. Blockchain technology is one of the fastest emerging technologies that can be applied for tackling construction

It is believed that some of the emerging blockchain applications can serve as a basis for a more tailored application for capital construction projects. Examining the cyber security aspect of blockchain application to construction projects is of huge importance to understand the potential risks associated with the application and how to prevent attacks from happening. This project focused on the construction supply chain (CSC) aspect of construction projects, providing detailed literature review process of the concept as well as issues and challenges associated. The project also provided a detailed literature review process on the blockchain technology alongside taxonomy of blockchain attacks and vulnerabilities. Furthermore, the research provided a case study of one aspect of CSC projects and a threat-model framework for potential attacks on the blockchain application.







ORAZGALIYEVA

Class of 2020 | Major Computer Engineering | Faculty Supervisor Chen Feng



#### DEEP LEARNING FOR TRAFFIC VIDEO **ANALYSIS**

Traditional highway transportation systems are monitored based on traffic counters. Such sensors provide much less information compared to traffic cameras and make the system less secure/resilient to attacks/disasters.

Thanks to the success of deep learning for object detection/segmentation on images and the publicly available large-scale image datasets with object labels, fusing the information from both traffic counters and traffic cameras has the potential to improve the security and resilience of existing highway transportation systems.

The purpose of the project was to investigate such a potential by developing a deep learning-based highway video monitoring method that can reliably estimate the fine-grained (car/truck/motorcycle) traffic flow of a highway network. We collected a large-scale traffic video dataset with traffic flow estimations from corresponding traffic counters. We then found efficient deep learning methods for extracting fine-grained local traffic information from individual traffic videos. Finally, we correlated this information with traffic counters for sensor fusion and detection of defective counters.





Class of 2021 | Major Electrical Engineering | Faculty Supervisor Nikhil Gupta

#### ARTIFICIAL NEURAL NETWORKS FOR MATERIALS DESIGN APPLICATIONS

Viscoelastic materials are characterized for their mechanical properties under a range of strain rates and temperatures through tensile tests and dynamic mechanical analysis. These methods tend to be costly and time consuming. In previous work, an artificial neural network (ANN)-based approach was successfully used to predict the elastic modulus of composites over a range of temperatures and strain rates. By extending this approach to the materials design field, we applied different ANNs, mathematical transforms and optimization methods to predict the weight percentage of polymers required to achieve specific mechanical properties. This was accomplished by collecting data of the mechanical properties for different weight percentages of a material, specifically polymers, by using an ANN to get the storage and loss moduli which were then transformed to the elastic modulus. By using methods of optimization we were able to determine the density boundaries and the corresponding weight percentages of the material to use as data for the final ANN. This work can be significantly utilized in the industry in order to determine the most suitable material for an application in a less costly and a more time efficient manner.

Class of 2021 | Major Electrical Engineering | Faculty Supervisor Mihalis Maniatakos



#### ANALYZING AND IMPROVING USABILITY AND APPLICABILITY OF THE E3 SOFTWARE FRAMEWORK

Encrypt-Everything-Everywhere is an easy-to-use open-source homomorphic encryption framework developed by the Modern Microprocessors Architecture Lab at NYU Abu Dhabi. The framework enables programmers to incorporate comprehensive privacy protections in the programs without expertise in cryptography. While the technical development has reached its final stage, the user interface needed much refinement. The goal of my summer research was to debug the software in both Linux and Windows environments, create an automated self-tests script, and organize the repository to be ready for publication. Moreover, I have worked on improving the user interface by creating an efficient user manual and a detailed tutorials program. The project included understanding and analyzing scripts written in C++, shell script, Python, and Makefile, and writing introduction file and set-up instructions that are to be published along with the framework.

#### MICHAIL (MIHALIS) MANIATAKOS

Associate Professor of Electrical and Computer Engineering; Director of the Modern Microprocessors Architectures (MoMA) Laboratory, NYU Abu Dhabi

Undergraduate summer research is a vital part of a healthy university. It allows undergraduate students to be exposed to state-of-the-art research, understanding cutting-edge research problems and methodologies. This can provide great context for students during their technical training through the curriculum. For example, the undergraduate students in my lab this summer learnt a lot about cryptography and the difficulty of reversing cryptosystems based on factorization. Many of them will take Data Structures and Algorithms next semester, so they will immediately understand why they are being taught complexity theory and algorithm analysis.

postdocs, and research assistants. This everyday interaction can help students make informed decisions about their next career paths, and whether they wish to pursue a PhD. Having undergraduate students involved in summer research is also beneficial for the research group. The students brought enthusiasm and fresh ideas. For example, Julie Liu, an NYUAD undergraduate, brought up a very interesting dimension in a project we were working on: Using instagram filters for adversarial machine learning - this research will hopefully lead to a publication.

Class of 2021 | Major Electrical Engineering Faculty Supervisor Mihalis Maniatakos

#### USABILITY COMPARISON OF FULLY HOMOMORPHIC ENCRYPTION **FRAMEWORKS**

This research looked at different fully homomorphic encryption frameworks such as SEAL, Cingulata, Marble, HEAAN and E3 and compares their usability. For that purpose, the installation as well as coding is compared, looking at the features the frameworks have and the operations that can be performed on them. With this in mind, the research introduced a new fully homomorphic encryption framework - E3 that has been developed in the Modern Microprocessors Architecture Lab at NYUAD and shows how it compares to other already existent frameworks. Overall, throughout this research I learnt a lot about encryption, more specifically about fully homomorphic encryption, why it is important, how it can be applied to areas of medicine, banking and advertising, how it has been implemented so far through different libraries and frameworks and what the future of homomorphic encryption will look like.

## **KASTRATOVIC**









#### USING VISUAL SERVOING WITH THE OPEN MANIPULATOR ROBOT AND THE OCAM TO PERFORM RELATIVE BEARING AND DISTANCE MEASUREMENTS OF FIDUCIAL MARKERS

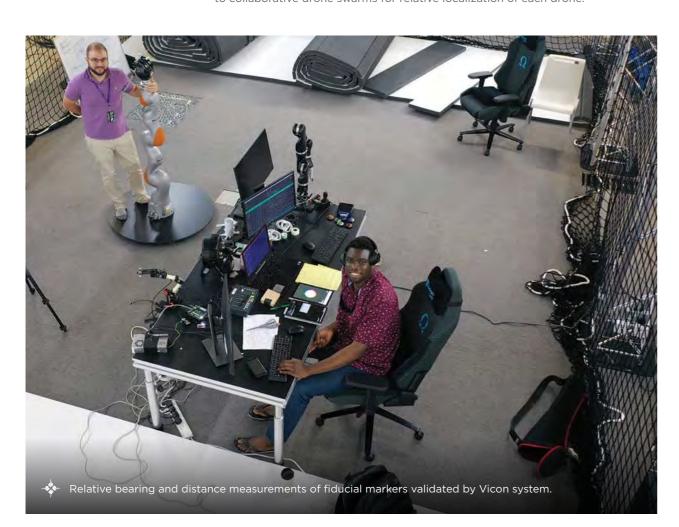
Class of 2020 | Major Computer Engineering | Faculty Supervisor Anthony Tzes

Relative localization is one of the main complications in collaborative drone swarms since each drone has to adequately measure the position and orientation of other drones and obstacles in real-time.

My research involved using visual servoing with the Open Manipulator robot and the oCAM to perform relative bearing and distance measurements of fiducial markers. The results are then validated using a Vicon system by measuring the transformation matrix of the Vicon system with respect to the oCAM, mounted on the moving Open Manipulator, and the Vicon system with respect to the stationary marker.

The inverse of the transformation matrix of the Vicon system, with respect to the camera, is then determined and the product of it and the transformation matrix of the Vicon with respect to the marker is compared with the transformation matrix acquired from the computer vision system.

With favorable results from this study, my computer vision system can be applied to collaborative drone swarms for relative localization of each drone.



## NOVEL ULTRACOMPACT PARALLEL STICK-SLIP NANOPOSITIONER

This research project focused on creating an ultracompact nanopositioner, which is a novel technology that is not yet commercially available, and has applications in many systems that require nano-positioning. At the Laboratory for Bio and Nano Instrumentation, the nanopositioner is used to combine the SEM (Scanning Electron Microscope) and AFM (Atomic Force Microscope). The nanopositioner was first designed in SolidWorks, and then manufactured using a CNC milling machine. The thickness of the nanopositioner was about 10 mm, which was achieved by having a parallel system that allows for movements in both the X and Y directions on a single plane. Each manufactured design was reiterated upon based on the electrical and mechanical testing of the whole assembly.

The AFM provides imaging capability with nanometer resolution, and the positioning system needed to be very accurate for high-resolution imaging and mapping. This was achieved in the eventual prototype.







Correlative AFM-SEM with a magnified view of the AFM cantilever.

## ABDULLAH ZAMEEK

# Supreme

#### **UGR**

Class of 2021 | Major Computer Science and Interactive Media Faculty Supervisor Hoda Alkhzaimi

#### CRYPTANALYSIS OF ROUND 1 NIST SUBMISSIONS FOR LIGHTWEIGHT CRYPTOGRAPHY STANDARDIZATION

With the rise of Internet of Things, the need for robust and secure, but computationally inexpensive ciphers have become more prevalent than ever before. Current industry standards such as AES are computationally too heavy and require more storage space than what these devices can offer. This project aimed to build a holistic design and analysis benchmark for NIST-proposed lightweight algorithms in C and Python based software platforms and on FPGA circuits.

The selected cipher was Saturnin-Short, part of the Saturnin suite of ciphers. This included performing analysis through potential side channels crytpanalytic techniques, and classic probabilistic cryptanalytic techniques such as linear, differential and impossible differential attacks, in an attempt to identify whether the Saturnin suite of ciphers would make a competitive candidate for the next generation of lightweight ciphers.

#### LIGE

Class of 2021 | Major Electrical Engineering | Faculty Supervisor Andras Gyorgy

#### CRISTIAN GARCIA

#### RUMAIL MEMON

AHMAD NASRALLA

#### SMART CLAMP

The research goal over the summer centered around the development of the Smart Clamp, a low-cost portable turbidostat, which is a microbiological device that would allow for the automated maintenance of a cell culture. Inspiration was taken from preexisting published designs of such turbidostats; however, several additional features were later incorporated into the design. The final prototype would include turbidity, weight, and orientation sensors, inductive wireless charging, and WiFi communication and control capabilities. The research work involved Arduinobased electronics, Arduino and Python programming, serial liquid dilutions, CAD modeling, and the assembly, calibration, and usage of a 3D printer. Professor Andras Gyorgy oversaw the work, providing constant feedback and guidance throughout the project's development. The final prototype will serve as a proof of concept for further development in the academic year.

#### "

#### **HODA ALKHZAIMI**

Research Assistant Professor, Engineering, NYU Abu Dhabi

The undergraduate summer research program provides unique and critical opportunities for participants to be actively involved in contributing to mentored research pathways of the different research groups and centers in NYUAD, NYU, and their extended global collaborators. This exposure enables the participants to accelerate interdisciplinary knowledge and research findings related to the subject of their studies, in addition to developing unique solutions and actively contribute to, in selected cases, industrial projects. The undergraduate students taking part in summer research at the Center for Cyber Security have worked on pioneering cyber security issues, including providing security analysis on self-driving cars, post-quantum lightweight cryptographic primitives, and proposing enhanced practical privacy models. These dedicated undergraduate summer research programs enables them to take part in graduate level publications and industrial collaborations.







#### SUNGMIN SOHN



**UGR** 

Class of 2021 | Major Civil Engineering | Faculty Supervisor Abdullah Khalil

## THERMAL PROPERTIES OF MAGNESIUM OXIDE CEMENT

In order to examine MgO cement performance in high temperature conditions, several experiments were conducted. Through the analysis of its thermal properties in ambient condition and high temperature conditions, we explored further possible sustainable applications in construction industries. The same experiments were undertaken with other supplementary additives being added to the MgO cement mix (fly ash, silica fume, micro silica). Their performances were then compared with the plain MgO cement samples in order to see the enhancement as well as to prove the MgO cement applicability.



#### ANTHONY CHUA



UGR

Class of 2021 | Major Biology | Faculty Supervisor Cassandra Thiel

#### INTERVENTIONAL RADIOLOGY LIFE-CYCLE ASSESSMENT

The United States healthcare sector contributes to over four million tons of waste yearly and 10 per cent of the nation's greenhouse gas emissions. Measures to reduce waste and emissions could save an estimated USD 15 billion over one decade, in addition to improved environment and public health outcomes. However, information is scarce on the environmental impact within the scope of a single hospital operating suite, where changes directly impacting clinical outcomes take place. Life-cycle assessments (LCAs) are used to calculate the environmental emissions of a product or system due to raw material extraction, manufacturing, transportation, product use, and end-of-life treatment. This study evaluated the total emissions per procedure from the vascular interventional radiology inpatient and outpatient suites of one hospital by using a process LCA, based on quantity of equipment manufactured, electricity consumed, and waste produced, and an economic input-output LCA, based on purchasing data for the equipment used.



#### KAI-WEN YANG



UGR

Class of 2020 | Major Electrical Engineering | Faculty Supervisor Sohmyung Ha

## CHALLENGES IN SCALING DOWN OF MILLIMETER-SCALE IMPLANTABLE NEURAL INTERFACES

Neural implantation for brain-machine interface is an emerging technology for continuous physiological monitoring, leading to more efficient and personalized diagnosis, treatment, and prognosis. It has also been developed as motor neuroprosthetic devices, improving the quality of life of many. Stimulation of targeted nerves has been utilized as an effective therapy for Parkinson's disease, essential tremor, dystonia, etc. Although initial designs were bulky, recent advances in semiconductor and nano-micro-technology has enabled the miniaturization of such devices to the mm-scale. This research project dealt with challenges resulted from decreasing the size of such implants, including issues pertaining to wireless powering, downlink/uplink data communication, neural signal recording, and neural stimulation. Through extensive literature research, simulations in MATLAB and ANSYS HFSS (High Frequency Electromagnetic Field Simulation), the limits and trade-offs regarding neural implant miniaturization were investigated and analyzed. State-of-the-art development and future trends for advanced neural interfaces were also explored.

#### UGR

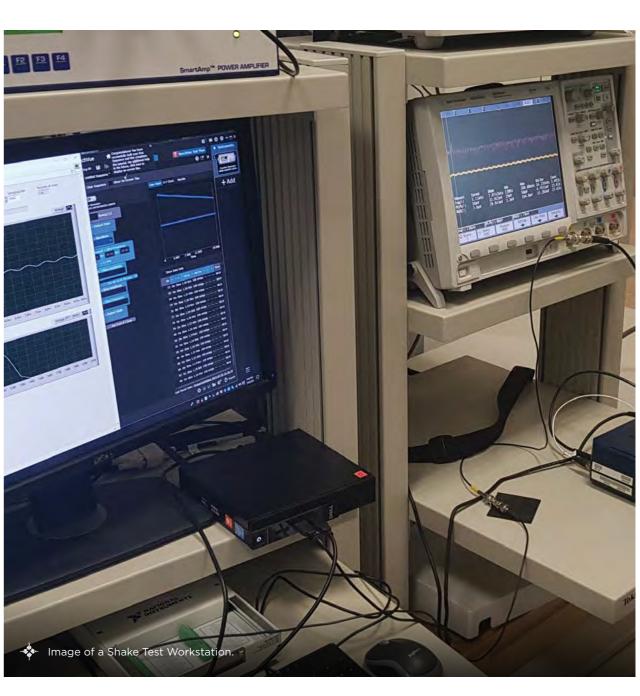
Class of 2022 | Major Computer Engineering Faculty Supervisors Philip Panicker and Francesco Arneodo

#### RAADSAT PROJECT

I was part of the Mechanical Team of the RAADSat Project: a CubeSat project in collaboration with Khalifa University and supported by the UAE Space Agency and Mini-Satellite Competition. The bulk of the work was to space-proof previously untested components of the satellites' payload by the means of stress testing using a shaker. I learned how to operate the shaker as well as its auxiliary data collection software – and spent a significant amount of time calibrating and adjusting the equipment setup to produce usable results, going back and forth between professors and other data results in an attempt to identify the sources of error that appeared in the data. I also assisted in hosting the Preliminary Design Review session for the entire Project. Having participated in the session I gained significant insight into the scale and overhead view of the complexity of the project.











UGR Class of 2020 | Major Electrical Engineering Faculty Supervisor Shivendra Panwar

#### LOW DELAY CONGESTION CONTROL PROTOCOLS OVER 5G MMWAVE LINKS

Congestion is a state that takes place in a network whenever heavy traffic exists, thus, slowing down the overall network response time. Conventional congestion control algorithms aim to utilize the available bandwidth while avoiding network congestion. Recently, many congestion control algorithms are proposed for reducing the end to end delay. Most adopted protocols have been developed with stable links in mind (i.e. generic internet or conventional 4G wireless links). Having different characteristics than pre-existing 4G links, the 5G mmWave links are known for rapidly varying capacity, intermittent outages, and short channel coherence times. Considering the commercial rollout of 5G, the compatibility of the existing congestion control algorithms and protocols over 5G links should be questioned. Low delay congestion control protocols have not yet been evaluated in this environment, and may not work as efficiently with 5G. As a result, we must revisit conventional congestion control protocols over 5G links. This project evaluated different congestion control algorithms on a test bed emulating a 5G mmWave channel. Through studying several congestion control protocols, such as TCP BBR, PPC, Remy, Sprout, Copa, and Verus, the project tested if the experimental results match the expected outcome for each protocol.



Tauseef, Mahrukh, Ken liyoshi, Ruth Gebremedhin, Mohamad Eid, and Vineet Gokhale, "Towards Standardization of Haptic Handshake for Tactile Internet: A WebRTC-Based Implementation". Proceedings of the 17th edition of the IEEE International Symposium on Haptic Audio-Visual Environments and Games (HAVE), Selangor, Malaysia (2019).





Class of 2020 | Major Electrical Engineering Faculty Supervisor Anna Choromanska

#### EXPLORING ADVERSARIAL PHENOMENA IN DEEP LEARNING-BASED AUTONOMOUS DRIVING APPLICATIONS

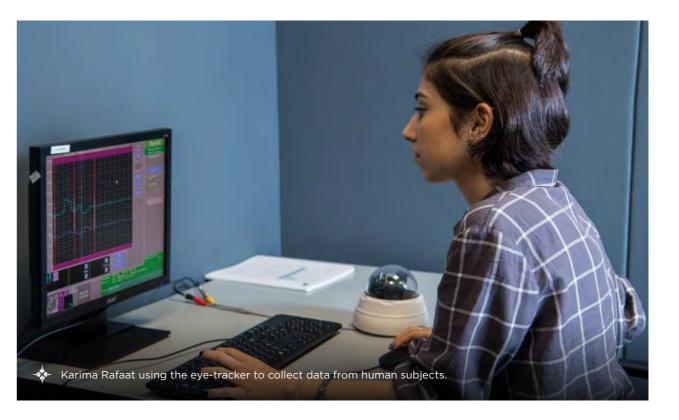
Autonomous driving has been a highly popular area of research in both academia and in corporate research and development. Just last year, Waymo, a subsidiary of Alphabet, started implementing self-driving taxi services, Apple purchased the startup Drive.ai, and Renault and Nissan have started developing autonomous vehicles for Europe and East Asia. While such technology has enormous potential, a lot of phenomena are still left to be fully explored. One such phenomena are adversarial examples, input data that cause machine learning algorithms to misclassify them and therefore raise cybersecurity questions about the physical world implementation of deep learning. My research investigated the three main methods of generating these physical world examples. I also developed algorithms for both discrete/classification and regression problems, one of which includes predicting Parkinson's disease stages based on voice recording data. The final phase combined this with a new idea called VisualBackProp using masks to make the algorithms more flexible.

Class of 2020 | Major Psychology | Faculty Supervisor Kartik Sreenivasan



#### REWARD-ATTENTION WORKING MEMORY

Our experiment aimed to better understand how flexible the working memory is. Specifically, we looked at whether changing the priority of different items we hold in memory will affect how each of them is represented in working memory. In our experiment, we manipulated the priority of different items by assigning higher probabilities to some items and less to others. In other words, we informed subjects that some items have a higher probability of being tested, and we tested to see if that will lead participants to remember some items with a higher precision than others. We hypothesized that the items assigned higher probabilities should be remembered with more precision, whereas the items with a lower probability should be remembered with less precision. Additionally, we tested for participants' response times and hypothesized that they should have lower response times for the higher-priority items and longer response times for the lower-priority items.



Class of 2020 | Major Psychology | Faculty Supervisor Kartik Sreenivasan

#### COMPARING METHODS OF ISOLATING THE BRAIN ACTIVITY CORRESPONDING TO THE MAINTENANCE PHASE OF THE DELAY TASK USING FMRI

Working memory (WM) is a space for temporarily storing task-relevant information and is important for a slew of tasks, from composing a sentence to playing chess. The delay task for studying WM consists of three contiguous phases: 1) the participant observes the stimuli, 2) maintains them in memory for a certain duration, and 3) reports what the stimuli were when prompted. This temporal segregation makes it possible to study the separate neural activity that underlies each phase of this task. Functional Magnetic Resonance Imaging (fMRI) confers the ability to study this activity with relatively high spatial resolution. However, the signal produced by fMRI lags behind neural activity by a few seconds, which poses an obstacle to the goal of isolating the neural activity that corresponds to each phase of the delay task. This research project, through simulating fMRI data with a known groundtruth of neural activity, evaluated methods that attempt to resolve this obstacle.





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JGR

Class of 2020 | Major Biology | Faculty Supervisor Dipesh Chaudhury



#### REGULATING RHYTHMS IN DEPRESSION: THE RELATIONSHIP BETWEEN SOCIAL DOMINANCE AND CIRCADIAN CONTROL IN DEPRESSION MANAGEMENT

Identifying the risk factors for depression is essential for appropriate intervention and early treatment. The impact of social status on depression, as well as its neurological mechanism of action, still remains under-explored despite the effect social hierarchies in both mice and humans have shown to have on depression-related outcomes. In order to develop an integrated theory relating social status and depression, we investigated whether circadian rhythm differences between dominant and subordinate mice explain why social status influences depression outcomes.

Depression-related symptoms such as social anxiety and anhedonia, along with circadian activity rhythms were recorded before and after the establishment of social rank. Differences in these variables will be complemented by in vitro brain slice electrophysiology to investigate the activity of key circuits between the medial prefrontal cortex and the dorsal raphe which link social status and depression-related centres in the brain, respectively. These findings will holistically address how social status can either mitigate or enhance the effects of depression.



#### PPTP

Major Biology: Brain and Cognitive Science | Faculty Supervisor Dipesh Chaudhury



#### IMPACT OF DIURNAL SLEEP DEPRIVATION ON SUSCEPTIBILITY TO STRESS

Counter to intuition, sleep deprivation for one night is a very effective antidepressant. Since sleep deprivation was first discovered to alleviate depression, research has uncovered a tight association between depression and sleep. It is well known that depression affects the organization of wake, NREM, and REM sleep states; however, it is less clear how exactly manipulating sleep states alleviates depressive symptoms.

Preliminary data in the Chaudhury Laboratory suggests that nocturnal sleep deprivation in mice is associated with depressive symptomatology by reversing early-night NREM and REM sleep patterns. This PPTP project asked whether diurnal sleep deprivation is also associated with this reorganization of sleep architecture. Using tethered electroencephalography and electromyography, my project piloted the research design required to assess the above research question and initiated the collection of evidence required to support or reject its hypothesis.

#### **DIPESH CHAUDHURY**

Assistant Professor of Biology; Principal Investigator, Laboratory of Neural Systems and Behavior, NYU Abu Dhabi

The Post-graduation Practical Training Program is a fantastic opportunity for our former undergraduate students to further develop their ability to think independently while learning new research techniques. Overall these experiences will enable the participants to develop skills relevant for a career in research.

#### UGF

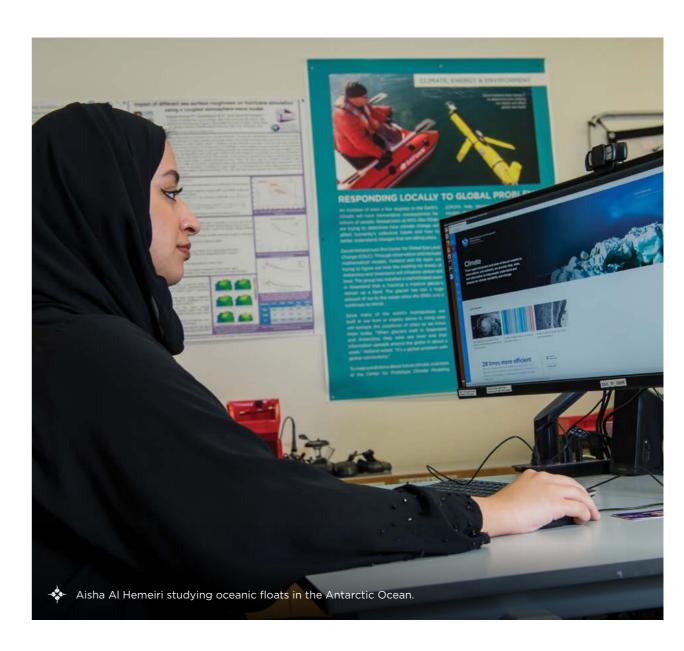
Class of 2020 | Major Computer Science | Faculty Supervisor David Holland

#### AISHA AL HEMEIRI

## ESTIMATING THE TRAJECTORIES OF OCEANIC FLOATS IN THE ANTARCTIC OCEAN

From 2014-2019, the Southern Ocean Carbon and Climate Observations and Modeling project deployed four oceanic floats in the Antarctic Ocean. The purpose was to produce a climate-quality data record to fill up the gap of information about the Antarctic Ocean dynamics. The floats descend to 2000m below the surface to produce scientific data profiles. Upon reaching the surface, the recorded data is transmitted via satellite at which point researchers receive the data. However, when it is the case that there is ice on the surface, to avoid being trapped, the floats store the data, descend to produce more data profiles, and wait until they reach an ice-free surface region to ascend and transmit the data. In such cases, the data is transmitted without its location, meaning that the trajectory of the floats in between data profiles is missing, rendering the data useless. This research project aimed to estimate the locations and trajectories of floats in under-ice cases to provide a well-rounded database of the Antarctic Ocean's properties.





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#### GAYATHRI SATHEESH

JGR

Class of 2020 | Major Biology | Faculty Supervisor George Shubeita

## ROLE OF MICROTUBULE ASSOCIATED PROTEIN 4 IN THE DNA DAMAGE RESPONSE/REPAIR PATHWAY

DNA damage can lead to mutations and chromosomal aberrations causing detrimental effects on health and progeny. Cells have developed complex defense mechanisms to detect and repair these damages: the DNA Damage Response/Repair pathway. Yet, a complete understanding of the DNA repair process and how it fails in diseases such as cancer remains elusive

We observed that Microtubule Associated Protein 4 accumulates in the nucleus upon induction of DNA damage, which suggests it might be playing a role in the DDR pathway. MAP4, was previously thought to only function outside the nucleus and regulate microtubule structure and function. This project aimed to investigate why it accumulates in the nucleus where there are no microtubules, and specifically upon DNA damage, and to explore its role in DNA repair. Understanding the DNA repair pathway can help in designing therapeutics for diseases rooted in DNA damage such as cancer.



The UAE Space Agency and the Higher Colleges of Technology (HCT) hosted an International Space Station student experiment competition, known as "Tests in Orbit". This competition invited university and college students in the UAE, working in teams, to develop, design and conduct a "nano-experiment". Students Majid Abbasi, Sion Hau, Shantanu Jain, Rumail Memon, Umang Mishra, and Ahmad Nasralla won the competition. Their experiment aims to understand a complex differentiation pathway taken by hematopoietic stem cells that are central to the functioning of the immune system, especially during extended spaceflight.





UGR

Class of 2020 | Major Biology | Faculty Supervisor Kirsten Sadler-Edepli

## DOES DNA HYPOMETHYLATION LEAD TO ONCOGENE-INDUCED SENESCENCE?

DNA methylation is an epigenetic modification in which methyl groups are added to DNA, which can affect the activity of the DNA molecule. DNA methylation is a key player in epigenetic silencing of genes, specifically when it is present in promoter regions of genes. The gene DNA methyltransferase 1 (*dnmt1*) is responsible for maintaining methylation patterns in humans. It is conserved in all vertebrates and has the homolog *dnmt1* in zebrafish. Zebrafish have fast reproduction, easy maintenance and the developing embryos are transparent, which makes them a good model organism for studies involving DNA methylation during embryonic development.

Pilot studies showed that mutating <code>dnmt1</code> in zebrafish causes DNA hypomethylation (decrease in methylation), and the mutants exhibit signs of senescence. Senescence is a process cells go through as they age which stops their proliferation. In some cases, it serves as a defense mechanism against tumorigenesis by preventing the proliferation of cells. One hypothesis is that the activation of oncogenes, which are genes with the potential to cause tumors, initiates senescence in the mutants. This project aimed to characterize senescence and investigate its mechanism in <code>dnmt1</code> mutant zebrafish, and whether it is oncogene-induced senescence.

#### **UGR**

Class of 2020 | Major Biology | Faculty Supervisor Kirsten Sadler-Edepli



## EFFECT OF THE MICROBIOME TO HEPATOTOXICANT AND MUTATION-INDUCED UNFOLDED PROTEIN RESPONSE ACTIVATION AND FATTY LIVER DISEASE

Fatty liver disease is the most common liver disease worldwide, but its mechanism is not completely understood. One way that lipid can accumulate in the liver is through a cellular stress response pathway which occurs when a stressor causes unfolded proteins to accumulate in a compartment inside all cells called the endoplasmic reticulum. This triggers the unfolded protein response, which is highly activated in some individuals and less activated in others even if they receive the same cellular stress. The source of this variability could explain the mechanism and suggest potential therapies for liver disease. One interesting source of homeostatic variation that has been implicated for research between individuals is the composition of one's microbiome. The microbiome is the trillions of bacteria, fungi, viruses, and archaea that live on or in an individual. In this project, the relationship between ER stress-mediated fatty liver disease and the microbiome is examined through observing the effect of toxins and genetic mutations that induce an accumulation of lipid in both germ-free reared and conventionally-reared zebrafish.





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UGR

Class of 2020 | Major Biology | Faculty Supervisor Youssef Idaghdour



## SINGLE-CELL ANALYSIS OF IMMUNE RESPONSE TO MALARIA INFECTION

The clinical spectrum of *P. falciparum* malaria infection ranges from asymptomatic parasite carriage to a severe life-threatening disease. Such variation in disease severity is determined by the interplay between the parasite and the human host immune system, which involves multiple layers of defense.

While there is growing consensus that both humoral and cell-mediated responses are needed for immunity, there are many controversies regarding exactly which components of the immune system play which role at which stage of the disease in conferring protection against severe malaria. There is also a lack of documentation of temporal changes in the immune cell composition of an individual and how that change affects disease severity. By coupling single-cell transcriptional profiling with functional studies, this study aimed to investigate how peripheral blood mononuclear cells respond to infection using blood samples collected from a pediatric cohort in Burkina Faso.



#### YOUSSEF IDAGHDOUR

Assistant Professor of Biology; Principal Investigator, Idaghdour Lab - Environmental Genomics, NYU Abu Dhabi

Summer research is a great opportunity to develop the concepts and methods of the Capstone project and gain a deeper understanding of the scientific process in general. Working in a research lab during summer offers students an excellent opportunity to develop a relationship with a faculty member and researchers in our program. Summer research in my lab focuses on enhancing quantitative skills that have become increasingly important in research. I push the students to learn computational skills on their own. They delve into statistical tools and programming languages such as R or Python. I don't let them get away with using software like Excel! They develop a skill set that is highly valuable for Capstone research and beyond.



#### UGR

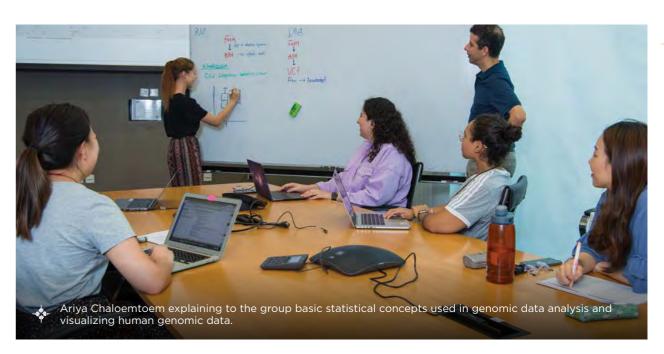
Class of 2020 | Major Biology | Faculty Supervisor Youssef Idaghdour



#### DYNAMIC CHANGES IN EPIGENETIC PROFILES OF PERIPHERAL BLOOD MONONUCLEAR CELLS IN RESPONSE TO MALARIA INFECTION

Malaria is a blood-born life-threatening disease that affects 300 to 500 million people annually, and is transmitted by Anopheles mosquitoes and caused by parasites of the genus *Plasmodium*. Upon infection, transcriptional activation of host immune cells including peripheral blood mononuclear cells (PBMCs) is initiated. However, variation in the host's immune response to infection is still not understood. This study aimed to investigate the role of epigenetics in modulating host transcriptional immune response to malaria infection using samples collected from children in Burkina Faso.

By conducting chromatin accessibility mapping using single-cell and bulk ATAC-seq and analyzing the transcriptome of PBMCs using RNA-seq before and after infection, the nature of changes in the epigenome and transcriptome of these cells throughout the course of infection will be better understood. This study provided valuable insight and resources that will assist in a deeper understanding of host in vivo immune response to malaria infection.











#### TULEEN SIHABI



Class of 2020 | Major Biology | Faculty Supervisor | Piergiorgio Percipalle

#### UNDERSTANDING THE ROLE OF NM1 IN **NEUROGENESIS**

Nuclear myosin 1 (NM1) has been implicated in key nuclear functions such as chromatin remodelling and transcriptional regulation. Transcriptional profiling by RNA-Seq on NM1 knockout mouse embryonic fibroblasts shows differential gene expression compared to the wild-type condition. The data shows that NM1 deletion significantly alters the expression of genes related to Alzheimer's, Huntington, and Parkinson's diseases. Moreover, the absence of NM1 disrupts the genes related to mitochondrial metabolism, which is highly interconnected with the aforementioned diseases. Hence, my project aimed to investigate the potential function of NM1 in neurogenesis and to understand its role in the etiology of neurodegenerative diseases. This was accomplished by preparing stable knockout mouse embryonic fibroblasts lacking NM1, which will later be reprogrammed to neurons and analyzed by RNA-seg transcriptional profiling. The project aimed to identify NM1 as a potential target for the treatment of neurodegenerative disorders.



**FALIS** 

Class of 2021 | Major Biology | Faculty Supervisor Stephane Boissinot

#### SPECIATION AND PHYSIOLOGICAL ADAPTATION TO HIGH ELEVATION IN ETHIOPIAN GRASS FROGS

This research aimed to investigate the character displacement in acoustic communication in syntopic, closely related species of Ethiopian grass frogs: Ptychadena cf. neumanii '1' and Ptychadena cf. neumanii '2'. Our research involved analyzing, comparing and contrasting calls from both species as well as running mate choice experiment for females. Our project also investigated the physiological adaptations to high and low altitude populations in Ptychadena cf. neumanii '2'. Combining physiological experiments with transcriptomic analysis, the project aimed to elucidate the mechanism of tolerance to extreme conditions in the aforementioned frog species.





Class of 2020 | Major Physics | Faculty Supervisor Serdal Kirmizialtin

#### DETERMINING RNA FOLDING INTERACTIONS THROUGH MOLECULAR DYNAMICS SIMULATIONS

This project aimed to provide a thorough and quantitative description of the folding process of a helix-junction-helix (HJH) RNA model construct assessing the energetic and entropic contributions of three molecular partners of RNA: water, counterions, and macromolecular crowders. The project relied on the use of all-atom molecular dynamics simulations to overcome the barriers imposed by the inaccurate predictions of Debye-Hückel theory in high concentration regimes. The goals of this research were divided into aims: (1) study the RNA conformation ensembles of an HJH RNA construct using molecular dynamics simulations, (2) quantify thermodynamic potentials (entropy, free energy) to measure the effect of solvent contribution in the stabilization of RNA constructs, and (3) study the effects of macromolecular crowding on RNA conformation ensembles in an effort to understand in vivo folding of RNA.

Class of 2021 | Major Biology | Faculty Supervisor David Scicchitano



#### THE ASSESSMENT OF DNA DAMAGE IN MUTANT NEIL 1, 2, AND 3 KNOCKED-**OUT CELL LINES**

DNA damage occurs by both normal metabolic activities such as transcription and from environmental factors such as UV light. DNA repair mechanisms are essential to maintaining the genomic integrity of a cell. Failure to repair DNA damage can result in deleterious outcomes such as cancer development and genetic disorders. It is therefore necessary to study and understand how cells respond to DNA damage so that their response to diseases such as cancer can be elucidated further. NEIL 1, 2, and 3 are DNA repair proteins that correct mutations in DNA caused by Reactive Oxygen Species (ROS) via a procedure known as base excision repair. This study aimed to knock out genes responsible for producing the repair proteins using CRISPR technology and study its effect on human cells.



#### DAVID SCICCHITANO

Professor of Biology and former Dean of Science, NYU Abu Dhabi

Summer research affords undergraduates the opportunity to engage in research full-time. This allows them to experience research and problem solving in a real-world scenario, uninterrupted by formal coursework. Whilst human cell lines that are defective in certain biochemical pathways that maintain genomic integrity. The work requires a time commitment that would be challenging during the academic year when classes are in session. The result? Oscar is learning an experimental technique that is widely used in labs to answer fundamental questions in the life sciences.

Class of 2021 | Major Biology | Faculty Supervisor | Mazin Magzoub



#### DEVELOPING TARGETED DRUG **DELIVERY SYSTEMS AND** THERAPEUTICS FOR CANCER

Doxorubicin and paclitaxel are two potent antitumor agents commonly used in chemotherapy. Encapsulating these two agents in nanoparticle systems can improve their target uptake efficiency and reduce harmful localization in healthy tissues. The nanoparticle system in this project consisted of three parts: a polylactic-co-glycolic acid core to which the chemotherapeutic drug can be loaded into; a bovine serum albumin shell that is cross-linked over the surface and important for maintaining nanoparticle integrity; and an acidity triggered rational membrane which provides pH specificity by targeting tumors which characteristically have lower extracellular pH compared to healthy tissue.

The uptake efficiency in breast-cancer and pancreatic cancer cell lines, MCF-7 and MIA PaCa-2 respectively, was measured in vitro through cell viability assays and through in vivo ectopic xenograft models. The cell viability assays showed pH dependent cytotoxicity of nanoparticle conjugated doxorubicin while further studies on paclitaxel internalization and in vivo models are still being studied.







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#### DECREASING CANCER GROWTH VIA THE REDUCTION OF GLUCOSE CONSUMPTION IN CANCER

The high proliferation rate of tumor cells demands high energy and metabolites that are sustained by a high consumption of glucose known as the 'Warburg effect'. The cellular consumption of glucose is initiated by an enzyme called hexokinase. The human hexokinase 2 (HK2) is one of five human enzymes that is important for glucose metabolism and it is over-expressed in all aggressive tumors. The project reported a new site that is distinct for HK2 that will be used to inhibit the cancer isozyme but not those found in normal cells. The high side effect of current anticancer treatment is a result of its low specificity to the tumor. In this project, we aimed to characterize the newly discovered inhibitory site to be used in the design of specific and safe anticancer treatments that will possess low side effect without interfering with normal tissues.



Vogel, Maria, Sunil Kumar, Debabrata Maity, Mazin Magzoub, and Andrew D. Hamilton. "Inhibition of Zinc-Mediated Amyloid Beta Aggregation and Cytotoxicity by Alpha Helix Mimetics." Biophysical Journal 116, No. 3, Pages 479a480-a (2019). DOI: 10.1016/j.bpj.2018.11.2590.





Class of 2022 | Major Mathematics | Faculty Supervisor Sofiane Bouarroudi



#### DOUBLE EXTENSIONS OF RESTRICTED MODULAR LIE ALGEBRAS OF HAMILTONIAN VECTOR FIELDS PRESERVING SYMPLECTIC FORMS WITH NON-CONSTANT COFFFICIENTS

My research project focused on double extensions of some restricted Lie superalgebras with nonconstant coefficients, which is an extension of "Computeraided study of double extensions of restricted Lie superalgebras preserving the non-degenerate closed 2-forms in characteristic 2" (Bouarroudj S., Leites D., and Shang J). In other words, the previous study classified double extensions of Lie superalgebras preserving non-degenerate bilinear forms with constant coefficients, while this extension aimed to study that of algebras preserving forms with nonconstant coefficients. This is important because similar objects are actively used in theoretical physics and mathematics and may lead to some new phenomena.

Class of 2021 | Major Computer Science | Faculty Supervisor Yasir Zaki

#### JAVASCRIPT DE-CLUTTERING ENGINE TO REDUCE PAGE LOAD TIME

A significant fraction of webpages, which are built using standard web tools and frameworks, suffer from the web bloat problem due to excessive and inefficient usage of JavaScript. Based on analyzing popular webpages, we observed that a reasonable fraction of JavaScript in every page are not truly essential for many of the functional and visual features of the page. In this paper, we proposed JSCleaner, a JavaScript de-cluttering engine that aims at simplifying webpages without compromising the page content or functionality. JSCleaner uses a classification algorithm that classifies JavaScript into three main categories: noncritical, translatable, and critical scripts. JSCleaner removes the non-critical scripts from a webpage, replaces the translatable scripts with their HTML outcomes, and preserves the critical scripts. We showed that JSCleaner achieves >3x reduction in page load times coupled with a 50 per cent reduction in the requested objects while maintaining about 80 per cent of the page visual and functional similarity for most pages.



WALEED

Major Biology | Faculty Supervisor Piergiorgio Percipalle

#### DNA DAMAGE DEPENDENT **REGULATION OF P53 PATHWAY BY** NUCLEAR MYOSIN I

Nuclear myosin 1 (NM1) is a key regulator of transcription and chromatin organization. Recent studies have highlighted the role of myosins in DNA repair, however how NM1 regulates that pathway is still unknown. Using NM1 KO MEFs, we showed that NM1 deletion leads to differential expression of genes involved in DNA damage and cell cycle. We found that genes that are downstream p53 signaling are down regulated and cells lacking NM1 display constitutive DNA damage foci. ChIP/ qPCR analyses on NM1 KO revealed that NM1 binding to the p21 gene is enhanced upon DNA damage and NM1 facilitates the binding of HAT PCAF and HMT Set1 to the p21 promoter region, leading to active expression of p21 gene. Thus, we proposed that NM1 plays a regulatory role in the p53 signaling pathway and is recruited across the p21 gene to facilitate recruitment of chromatin remodelers, leading to p53-dependent p21 gene activation.



Major Physics | Faculty Supervisor Ian Dobbs-Dixon

#### STABILITY OF HABITABLE PLANETS IN 55 CANCRI

This study aimed to investigate the orbital stability of potential Earth-like planets within the habitable zone of exoplanetary system 55 Cancri through running numerical simulations. 55 Cancri is a binary star system that hosts five known planets. A gap in-between the planets had been observed that coincides with the system's habitable zone, making the possibility of the existence of a habitable planet more likely. Thus, this has motivated searches for Earth-like planets within the habitable zone of the system, and encouraged multiple orbital stability studies. However, as the system's binary star resides 1000AU away from the main star, it has been omitted from these studies. This project explored the potential effects of the binary star on the stability of a potential habitable planet.











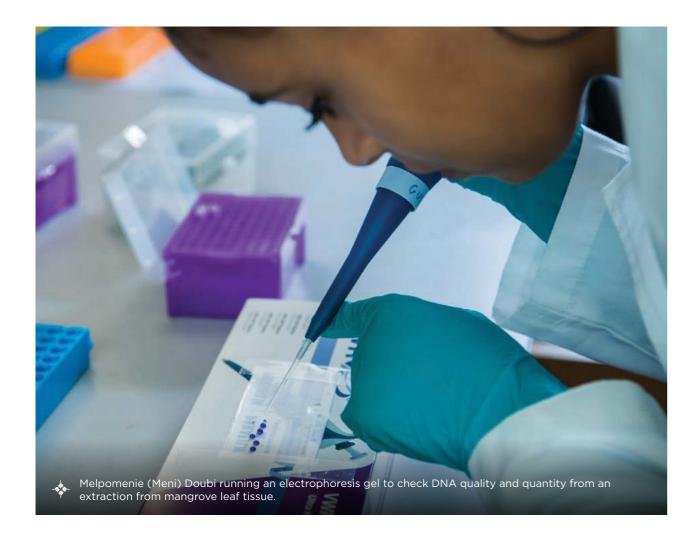


#### MELPOMENIE **GUISSOUEGOU** DOUBI

Class of 2021 | Major Biology | Faculty Supervisor John Burt

#### MARINE BIOLOGY RESEARCH

Sea urchins are important for maintaining the balance between corals and algae. This research project focused on counting the number of sea urchins in different reef sites of the Arabian Gulf to see how climate change and coral reef bleaching impacts the number of urchins. This research also analyzed how different fish species behave in different water temperature; for example, analyzing their metabolism, boldness and eating habits. Researchers within the lab also applied genomic techniques to study how mangroves have adapted to the extreme environmental conditions of the Arabian Gulf.





Paparella, Francesco, Chenhao Xu, Grace O. Vaughan and John A. Burt. "Coral Bleaching in the Persian/Arabian Gulf Is Modulated by Summer Winds." Frontiers in Marine Science 6, Page 205 (2019). DOI: 10.3389/fmars.2019.00205

Class of 2020 | Major Physics | Faculty Supervisor Paul Chaikin

#### CHARACTERIZING EMERGENT STRUCTURES IN COLLOIDAL SUSPENSIONS SEDIMENTING DOWN AN **INCLINE**

The sedimentation of colloidal suspensions on an incline can be drastically affected by the presence of a nearby no-slip boundary which gives rise to an instability never studied before. This instability is in the form of periodic finger-like structures that form at the traveling front of the particles. This project studied the instability to identify the relevant parameters that give rise to these finger-like structures and determine its wavelength. This was done through observing the behavior of various experimental setups concurrently with recently developed numerical simulations by collaborators at the Courant Institute of Mathematical Sciences. To conduct the experiments, a microscope was built on a mount capable of being rotated 360 degrees. Through theoretical considerations, inclination angle and gravitational height of the particles were identified as variables of interest. The acquired data was analyzed alongside the simulations and theoretical models to gain a better understanding of the dynamics of this system.



Major Psychology | Faculty Supervisor Daryl Fougnie

#### ACCESSING REPRESENTATIONS IN PERCEPTION AND MEMORY

Previous studies revealed both considerable overlap between attention and memory and differences in how certain representational properties modulate these two constructs. This project sought to draw comparisons between how representations in working memory and in perception are accessed. We investigated how selection operates over spatial and non-spatial properties, such as object groupings and verbal information, in the memory search paradigm that requires participants to select and update certain features in memory. In an additional experiment I explored whether shifting attention to task-relevant information within memory influences the conscious detection of unexpected, but salient events at the cued location.

Class of 2020 | Major Physics | Faculty Supervisor Mallory Roberts

#### PLUCKING THE WEB: SEARCHING UNASSOCIATED FERMI GAMMA-RAY SOURCES FOR SPIDER PULSARS WITH JERKSEARCH ALGORITHM

The Large Area Telescope aboard the Fermi Satellite has identified thousands of Gamma-ray sources, many of which are postulated to be binary millisecond pulsars (MSP). However, a large number of them remain unassociated with an MSP due to the use of acceleration searches which are only effective when the observation time is less than 1/10th of the orbital period. We used the novel jerksearch algorithm implemented in the PRESTO software package to re-search Fermi sources that remain unassociated. Jerksearch is sensitive to changes in the period of the pulsed signal caused by the second derivative of the orbital period, resulting in increased sensitivity to tight binary systems. We used radio data gathered from the Green Bank Telescope in Virginia, at a central frequency of 820 MHz, as part of the Fermi Pulsar Search Collaboratory. The Dalma HPC at NYUAD was used for required computations.





YIN-TING



**SHAWAIZ TABASSUM** 









#### EFFECT OF IMPLICIT RACIAL BIAS ON RECOGNITION OF OWN, VERSUS OTHER-RACE FACES

Previous research has established a possible link between recognition performance and implicit racial biases of other-race faces. This project examined how recognition of own- and other- race faces might be modulated by observers' face recognition ability, social experience, and implicit social biases. Caucasian participants (N=53) completed a memory task for Caucasian and Asian faces, an implicit association test, a questionnaire on social experience towards Caucasians and Asians, and a face recognition ability test (Cambridge Face Memory Test).

During the memory task, eye-tracking was used to track participants' eye movements. The memory performance for own-race faces was positively predicted by increased face recognition ability only, whereas the memory performance for other-race faces were positively predicted by increased face recognition ability, social experience with Asians, and negatively predicted by increased positive bias towards Asians, which was modulated by an interaction between face recognition ability and implicit biases with the effect of bias observed only in observers with high face recognition ability.

Eye tracking data revealed an interaction between race and fixation location. These findings suggest the complexity in understanding the perceptual and sociocognitive influences on the other-race effect, and that observers with high face recognition ability may involuntarily allocate spare cognitive resources to evaluate racial factors when recognizing other-race faces.



#### NORTH ECLIPTIC POLE VLBA SURVEY

Using the Very Long Baseline Array telescope, we looked at the hearts of galaxies in the North Ecliptic Pole. Our survey has one of the highest sensitivities ever achieved. This allowed us to determine which galaxies produce radio emissions due to formation activity, and which ones due to Black holes/Active Galactic Nuclei (AGNs) located at their hearts. Additionally, we performed a multiwavelength study of the more than a hundred radio sources detected in the survey. By comparing the radio emissions with Infrared, optical, and X-ray emissions, we learned how the AGNs produce jets, and how these jets affect their host galaxies and the surrounding intergalactic medium. Due to the nature of this study, we worked with scientists and telescopes located all over the world, and even in space. This shows that the further development of science relies on the integration of the international community across all disciplines.





#### CHERN-SIMONS CLASSES

Chern-Simons forms are a type of secondary characteristic classes with great relevance in. Explicit computations of these forms are often missing in the literature, and are required by researchers in the field. Based on a combinatorial analysis, we proposed new formulae for standard Chern-Simons forms and tabulate explicit computations of several cases. We also extended our analysis and computations to generalizations of Chern-Simons forms, such as Cheeger-Chern-Simons forms, Chern-Simons forms on super vector bundles, and Bott-Chern forms. Results concerning the relations of other characteristic classes, such as Chern, Pontryagin, and Segre classes, were also discussed.

Class of 2021 | Major Mathematics and Physics | Faculty Supervisor Hisham Sati



Class of 2021 | Major Psychology | Faculty Supervisor Antje von Suchodoletz

#### KEEPING AN EYE ON CLASSROOM **EVENTS: AN EYE-TRACKING STUDY ON** TEACHERS' VISUAL PROCESSING

The project's objective was to explore teachers' visual attention during classroom interactions and to link teachers' eye gaze to key events in classroom interactions. The sample included 37 kindergarten teachers recruited in schools in Abu Dhabi. By utilizing a combination of eye-tracking data and retrospective interviews, this research aimed to contribute to a new model of understanding the mechanisms underlying teacher professional vision, as barriers or facilitators, to high-quality instruction. The following two research questions were investigated: (1) How do teachers distribute visual attention during real-time teaching? and (2) Can teachers' cognitive and metacognitive processes explain individual differences in teachers' visual attention? This project went beyond previous research on teacher professional vision by focusing on teachers' visual attention in real-time, which is possible due to recent innovations in mobile eye-tracking technology. The findings of the research provided evidence-based information and guidance which can contribute to the formulation, development, and implementation of educational policy, teacher education, and practice.





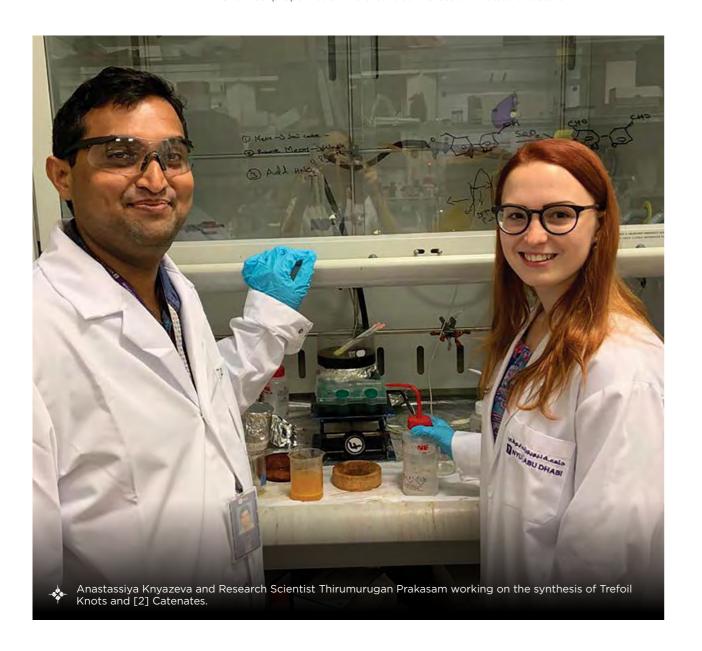


Major Chemistry | Faculty Supervisor Ali Trabolsi



#### METAL ORGANIC NON-TRIVIAL MOLECULES: FROM STRUCTURE TO APPLICATION

Molecular knots are the most frequently observed knotted topology in protein and DNA. Knotted topologies play important roles in protein and DNA function by enhancing their catalytic activity, ligand-binding affinity, and increasing their macromolecular thermodynamic, kinetic, and mechanical stability. Coordination driven self-assembly has been established as a nice protocol towards the synthesis of complex architectures including molecular knots. However, reports on the practical application and utility of such molecular knots remain very limited. In our research group we explored the preparation of metal-based molecular knots and their use in six potential new applications: (i) anion binding, sensing and transport (ii) catalysis, (iii) protein-protein interactions inhibition, (iv) anti-cancer agents, (v) photo-switchable molecular nanomachines and (vi) explored the physical and chemical properties of the extended molecular knotted structure.



Class of 2022 | Major Physics | Faculty Supervisor Ingyin Zaw



#### AGN OPTICAL IDENTIFICATION, REDUCTION AND ANALYSIS OF MASER SPECTRA. ANALYSIS OF VLBI MASER

This project focused on Active Galactic Nuclei (AGNs), the most luminous objects in the universe, and masers (Microwave Amplification by Stimulated Emission of Radiation) in AGNs. I identified AGNs from optical spectra taken from 6dFGS and only marked the AGN optical spectra that need to be refitted due to misalignment and/or messed up arm combination. The second part of this project involved data reduction and analysis of single-dish water megamaser spectra using GBTIDL, a package for analysis and reduction of spectral line data. The final aspect of the project dealt with analysis of the Very Large Baseline Interferometry (VLBI) maser maps.

VLBI analysis will enable extremely accurate determination of the geometric distance to the water megamaser host galaxy, as well as accurate determination of the mass of the Super Massive Black Hole of that galaxy. If done for many megamaser host galaxies, this method, which determines geometric distances to megamaser hosts directly, is not limited by systematic errors as in the case of using standard candles. The distances determined via this method can therefore allow precise measurement of the Hubble constant, thereby constraining models of dark energy.



Russell, David, M., Daniel M. Bramich, Fraser Lewis, Aisha AlMannaei, Thabet Al Qaissieh, Ahlam Al Qasim, Aisha Al Yazeedi, Maria Cristina Baglio, Federico Bernardini, Nour Elgalad, Aldrin Gabuya, Jean-Pierre Lasota, Alejandro Palado, Paul Roche, Hinna Shivkumar, Silviu-Marian Udrescu and Guobao Zhang. "Optical precursors to X-ray binary outbursts." Astronomical Notes 340, No. 4, Pages 278-283 (2019). DOI: org/10.1002/asna.201913610.



Class of 2020 | Major Physics | Faculty Supervisor Jospeh Gelfand

#### UNDERSTANDING THE COSMIC RAY PRODUCTION OF SUPERNOVA REMNANTS

The earth atmosphere is constantly bombarded by cosmic rays, which are particles from outer space. More than one hundred years since the discovery of these particles, their origin as well the factors that enhance their productions remain unclear. It is believed that supernova remnants - the structure left after a star undergoes a supernova explosion - are most likely responsible for producing such particles. This argument requires that supernova remnants be on average 10 per cent efficient at producing cosmic rays.

While supernova are frequent in the galaxies - two to three explosions every century - very few remnants show evidence of particles acceleration. Hence, it is unclear whether supernova remnants are responsible for most the cosmic rays observed as well as how their properties affect how their efficiency at producing cosmic rays. This project sought to bridge such gap by identifying supernova remnants that show evidence of highly efficient cosmic ray production and studying how their properties enhance such production. This project resulted in a deeper understanding of how cosmic rays are produced, and hence provided strong insights into how galaxies form and evolve.







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UGR

Class of 2020 | Major Chemistry | Faculty Supervisor Pance Naumov



## GROWTH AND CHARACTERIZATION OF ORGANIC CRYSTALS

During the summer, I worked on growing organic crystals that could potentially present elastic, superelastic, and/or ferroelastic properties. Understanding the role of structure in the physical properties of molecular organic crystals can help establish interesting paradigms in a variety of fields, namely electronics, nanotechnology, self-actuation, and biomimetics. My summer research experience allowed me to become more curious about how we can grow such crystals and what kind of applications they may have, taking into account their molecular structures and physical properties.



#### 

#### PANCE NAUMOV

Associate Professor of Chemistry and Principal Investigator, The Naumov Research Group, NYU Abu Dhabi

Working with students over the summer, without the burden of coursework and in a more relaxed setting than usual has been an incredible experience, both for the students and for their research supervisors. Most of the summer research students in my lab have worked on a new class of smart materials - materials that sense and respond autonomously, which are thought to be the pillar of the Fourth Industrial Revolution. The operation of some of these materials is inspired by or harnesses the natural principles that have been developed over the millenia; others are geared towards specific applications, such as use in optics, robotics, or electronics. Much of this research has evolved as a simple idea over a coffee break and developed into publishable research that has appeared in some of the leading chemistry journals such as *The Journal of the American Chemical Society*, Angewandte Chemie and Chemical Communications. For some students, this research experience was the inspiration to take on a graduate projects related to materials science. Overall, summer research is an excellent opportunity for talented, motivated students to engage in exciting research projects beyond their courses or Capstone project, and it is there that one can actually see the true excitement of a student in a research lab where high-end equipment is available.

#### UGR

Class of 2020 | Major Social Research and Public Policy Faculty Supervisor Malte Reichelt

#### INTEGRATION AMIDST CRISIS: ASSESSING THE SOCIAL NETWORKS OF CHILDREN IN GREEK PUBLIC SCHOOLS

This project studied the social integration of students in a Greek middle school located in a diverse neighborhood of Athens. The project aimed to understand the school's response to the recent wave of refugee students and how this affected students' academic and social experience. Phase One used qualitative interviews to understand the school's role in the community and the school's reaction to an influx of refugee students. The strengths and challenges of the school were gathered through interviews from teachers, parents of students, and other community stakeholders. Phase Two will use quantitative surveys with students to assess elements of the school that aid or hinder their social integration, especially between refugee and non-refugee students. My Capstone project will examine the gaps in the school's response to adapting the environment for refugee students and will describe the best practices the school has done to facilitate a healthy social community among students.



**KATIE** 

#### IGR

Class of 2020 | Major Economics and Political Science Faculty Supervisor Arvind Panagariya

## STUDY ON EMPLOYMENT AND PRODUCTIVITY TRENDS IN INDIA

Since 2014, India's economy has been the fastest growing major economy, thanks to its young population, high investment rates, and increasing integration into the global economy. However, economic growth is still significantly hindered by inflexible labor laws and labor market rigidities: labor force participation rates have fallen sharply; youth unemployment remains stubbornly high; an overwhelming portion of the labor force continues to work in the informal sector; and there is little evidence of a sustained rise in wages for unskilled workers. Our project aimed to identify and analyze the underlying causes, and to then suggest optimal solutions. The project sought to provide answers for some of the most relevant and puzzling questions surrounding the Indian economy and India's labor market. The resulting datasets and papers will contribute to the field of research on the Indian economy and serve as policy recommendations for the Indian government and for governments of countries in similar circumstances.



Major Economics | Faculty Supervisor Christopher Paik

#### LONG RUN ECONOMIC OUTCOMES OF ANCIENT NOMADIC TRAVEL ROUTES IN THE HIGHLANDS OF ASIA

Works on the impact of transportation infrastructure are primarily comparison studies across periods or location settings (rural versus urban). These works fail to include how a location's geographic terrain characteristics might influence the emergence of economic activities. Similarly, the conventional narrative among these existing works depends on the construction of actual transportation infrastructure which leads to a lack of exogeneity variation in the studies. This research confined the study to a fixed geographic setting (Asian highlands), which faces its own sets of challenges and barriers to infrastructure development. To overcome the lack of exogeneity in the study, we used simulated travel routes taken by nomadic pastoralist for hundreds of years in the region as a proxy for the transportation network. We made use of nightlight intensity, population density, locations of road networks, and cities' locations to study how closely contemporary economic activities are established around the ancient travel routes. We found that there are positive economic outcomes in the region where simulated travel routes existed suggesting a long-lasting positive effect of infrastructure development on the economy.









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DALVIN J. MWAMAKULA

UGR

Class of 2022 | Major Social Research and Public Policy Faculty Supervisor Janet Njelesani

SERRA OKUMUS

UGR

Class of 2021 | Major Political Science | Faculty Supervisor Janet Njelesani

VICTORIA ZHU

UGR

Class of 2021 | Major Psychology | Faculty Supervisor Janet Njelesani

JURIA SATO BAJRACHARYA

UGF

Class of 2020 | Major Economics | Faculty Supervisor Janet Njelesani

MOHAMMED WASEEM GULAM

UGR

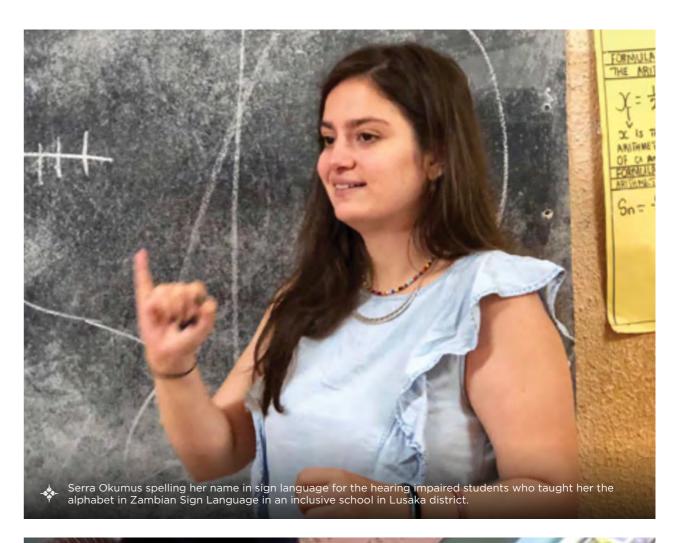
Class of 2020 | Major Psychology | Faculty Supervisor Janet Njelesani

This summer, we travelled to Zambia, a landlocked country in southern Africa with incredibly hospitable people and wide cultural diversity with 72 ethnic groups. As a team of students from NYUAD with various backgrounds, we assisted Professor Janet Njelesani from NYU Steinhardt's Department of Occupational Theory on her research on school violence against students with disabilities in Zambia. Through conducting observations in schools, and leading workshops and interviews with youth with and without disabilities, parents, inclusive education teachers, administrators, government representatives, and non-governmental organizations across multiple provinces of the country, we generated qualitative data on perceptions of the causes, nature, and results of, as well as responses to school violence against students with disabilities.

While doing field research, we learned that our purpose as qualitative researchers was not to discover the truth; but rather each individual's experience is as important as another's, no matter how different they may be. The most rewarding aspect of our work has been speaking with students with disabilities and their teachers one-on-one to learn from their experiences and ideas for change. The interviews have given us much to reflect upon, particularity how best to build rapport with students with differing abilities and strengths, and how to carry out sensitive research that is culturally appropriate and meaningful to the youth and their community.

Overall, we have experienced a unique learning opportunity in Zambia that is not always available to undergraduate students; we were able to move beyond seeing people as reduced to numerical values in enormous data sets or a couple of quotes in an academic paper, instead, we sat across from people in the corner of a classroom and talked about what is most important to them.









#### JAKUB BARTOSZEWSKI



Major Economics | Faculty Supervisor Abdul Noury



## THE RECENT PHENOMENON OF POPULISM IN FUROPE AND THE US

The rising wave of populism started with the Brexit referendum in 2016, which was followed by election of Donald Trump as the US President in the same year.

The subsequent events were marked by an increasing support for populist parties such as UKIP of the UK, Front National in France, Fidesz in Hungary or Aktion for Deutschland in Germany. Our research started with comparing various academic definitions for the term populism as there remains a large ambiguity in the field about this matter. We finally arrived at a conclusion that populism can be most accurately defined as a style of rhetoric marked with a thin-ideology, namely a way of expressing particular information within the political ecosystem which can be connected with an ideology like conservatism, libertarianism, socialism. Furthermore, we defined that there are two broad types of populism – libertarian populism (left-wing) and authoritarian populism (right-wing; 'alt-right').



#### PPTP

Major Economics | Faculty Supervisor Ernesto Reuben



#### DIFFERENCES IN PERCEIVED GENDER REPRESENTATION OF PROFESSIONS IN LABOR MARKET

Impact of gender in labor markets has been widely studied over the last decades. While research has showed that gender is an important determinant variable both in terms of horizontal and vertical growth opportunities, as well as pay, there are still many questions about the topic.

This research project studied the differences in perceived expectations of who should perform a certain role. We aimed to contribute to the literature by creating knowledge that would extend previous research on existing gender divide amongst professions, by analysing the trend of gender divide in professions from Google Image search output.



#### UGR

Class of 2020 | Major Economics | Faculty Supervisor Heitor Pellegrina



## THE INFLUENCE OF EXCHANGE RATE FLUCTUATIONS ON DEFORESTATION RATE IN RUSSIAN FEDERATION

The goal of my project was to investigate the effects of the exchange rate fluctuations on the boreal forest loss in the Russian Federation. Once the relationship is established, one can determine which regions of the country are the fastest to respond to the price changes, and which characteristics allow them to do so. The knowledge is relevant in the political context since it would shed light on the aspects of the wood industry the government should address if it desires to control the high rate of the forest loss observed in the past two decades. Moreover, the investigation contributed to the discussion on the possible solutions to the greenhouse emissions problem: if it is possible to predict the regions that respond to the price fluctuations of wood at the international markets the most, protective measures can be taken to preserve the forest from both legal and illegal logging.

#### PPTP

Major Social Research and Public Policy | Faculty Supervisor Elisabeth Anderson

## CHILDREN OF CAPITAL: INSTITUTIONAL ENTREPRENEURS AND THE ORIGINS OF REGULATORY WELFARE

As the industrial working classes entered into a liberalized market in the late 19th and early 20th centuries defined by laissez-faire ideologies, workers with rights not formally protected via state authorities faced an array of abuses on the labour market. Children of Capital: Institutional Entrepreneurs and the Origins of the Regulatory Welfare State examined the development of state responses and institutional expansion to counter the most extreme abuses by focusing on one of the earliest topics addressed in such policy: child labor. Taking Germany, France, Belgium, and the US states of Massachusetts and Illinois as empirical examples, the research takes a historical approach to trace the development of not only child labor laws, but also regulatory bodies in their respective locations and time periods. Through comparison of the data, it is shown that individual policy entrepreneurs played a central role in advocating and implementing reforms, but with varying degrees of success. This research sought to examine the challenges and contributions of such institutional entrepreneurs in combatting child labor and establishing the foundations for the regulatory welfare state across the US and Europe.





#### PPTP

Major Social Research and Public Policy and Psychology Faculty Supervisors Hirokazu Yoshikawa and Alice Wuermli

#### LEGO (GLOBAL TIES)

The LEGO Foundation recently awarded USD 100 million to Sesame Workshop, the International Rescue Committee, BRAC, and Global TIES for Children to provide play-based early childhood development services to children affected by the global refugee crisis. The new award builds on existing partnership and on a previous USD 100 million grant from the John D. and Catherine MacArthur Foundation. Global TIES for Children acts as the independent evaluation partner, with Dr. Hirokazu Yoshikawa and Dr. Alice Wuermli leading the project's evidence-based research and evaluation activities. This summer I helped Global TIES team with researching the measures for the evaluation plan. My primary tasks included: looking for additional measures of pre-migration context and current stressors/difficulties, demographics, mental health of Rohingya refugee women, as well as checking whether the measures selected for the project evaluation have been validated in Bangladesh and humanitarian contexts and pulling these measures out.



Major Economics | Faculty Supervisor Etienne Wasmer

## BRIEF HISTORY OF HUMAN TIME PROJECT

The project focused primarily on improving and extending the Brief History of Human Time Research paper published in 2016 and is to some extent the 2.0 version of the previous paper. The original version collected about 1.2 million notable people and 7,184,575 locations (geolinks) associated with them throughout human history (3000BCE-2015AD) and at the start of the summer, as part of the 2.0 project, had collected 4.7 million entries about notable individuals as well as their geolinks. The majority of the data came from scraping Wikipedia and Wikidata public pages. The team started a new data collection in Wikipedia editions in Russian, Bielorussian, Polish, Urdu, Chinese and Japanese and figured out about ways to depict the findings in both academic and interactive ways interactive ways, with the aim of publishing results in a paper, as well as making an animated video.

#### ANASTASIIA ZUBAREVA











Major Economics | Faculty Supervisor John Ham



#### ESTIMATING LABOR MARKET PARTICIPATION AND EMPLOYMENT TRANSITIONS FOR DISADVANTAGED SINGLE MEN IN THE UNITED STATES: EVIDENCE FROM THE SIPP

Low-educated, young, single men in the United States are an understudied demographic group with a high poverty incidence and a low labor force participation rate. Moreover, their situation has deteriorated since the onset of the Great Recession. This research described the transitions of single men, aged between 25 to 54 years, with a high school degree or less, in and out of the labor force, and in and out employment. I tied their labor market participation and employment behavior to economic conditions. Using the Survey of Income and Program Participation dataset from 1995 to 2015 and employing a dynamic probit model, I showed that labor market participation and employment status in the previous period overwhelmingly influence their status in the current period. I also found that their transitions are substantially affected by changes in the state-level unemployment rate, but not from changes in the minimum wage. I estimated these effects for my whole sample and by race. I also conducted a sensitivity analysis.



Ahmed Meshref's Capstone project on the transitions of single men with high school degrees or less, in and out of the labor force, and in and out of employment clinched the top prize in the Accounting, Economics, and Finance category at the seventh annual Undergraduate Research Competition held at Abu Dhabi University.



Class of 2020 | Major Political Science and Economics Faculty Supervisor Sigi Han



#### LIBERAL ARTS EDUCATION

The main research focus was the Liberal Arts Education Index project, where we aimed to answer the question: "How does liberal arts education impact an individual's development after graduation?" My research involved working on data exploration, collection, and analysis. For the data exploration part, I looked into potential datasets online that can be used to reflect university graduates' performance in their later career. I used Python's BeautifulSoup to scrape online text data, and examined the sample data to extract useful terms and phrases that reflect alumni's career achievements. The team is running text analysis on syllabi data we collected, and we hope to match the career description reflection of alumni with the universities' course syllabi to see if courses taught at universities translate to certain characteristics in alumni's careers.

Class of 2020 | Major Social Research and Public Policy and Economics Faculty Supervisors Daniel Karell and Rabia Malik



### REVIEWS, RATINGS, AND RESILIENCE: THE PROMISES AND PERILS OF REVEALING LABOR MIGRANT, JOB AGENT. AND RECRUITMENT FIRM NETWORKS

This project aimed to answer two related questions. First, do specific kinds of information improve migrants' recruitment experience in the country that they are emigrating from? Second, how do job recruiters in that same country respond to better-informed migrants? The broad goal of this project was to better understand the relationship between aspiring migrants and those job agents who help connect such migrants with overseas employment, and to learn more about ways in which this experience can be made better for the migrants, especially because these migrants often lack information about the recruitment process and about the specifics of the jobs that they will be getting. The project involved a field experiment conducted with migrants and agents in Pakistan over the course of several months. This experiment entails collecting baseline data through an interview with participants, using a mobile phone application to send information (about job opportunities) to some participants and not others, using the phone app to collect immediate responses of participants, and then conducting an endline interview.

The project's findings will offer direct insight into methods used to develop and deploy a tool to identify, review, and rate actors in the migrant-agent-recruiter network - and then share this information while mitigating negative unintended consequences, as well as identifying the relationship between those actors.

Major Political Science | Faculty Supervisor Daniel Karell



#### MERCHANTS OF RADICALISM

How are radical ambitions packaged and broadcast to a wide public? This study explores the rhetoric used to justify and spread ideas of dramatic social change.

Through a comparison of a large corpus of propaganda produced by Afghan militants (1979 to 2001) and American right-wing provocateurs (2009 to 2018), we first show how these individuals called for an upheaval of existing social systems -they were, and are, radicals. We then identify common rhetorical strategies used to make radicalism more agreeable: claiming moral righteousness; crafting notions of victimhood; and basing calls for action on false equivalencies.



#### DANIEL KARELL



62 SOCIAL SCIENCE SOCIAL SCIENCE 63

**Tadevosyan, Gurgen.** "The issues of legal-political thought introduced by Dr. Vazgen Hakobyan in his analysis and edition of the VII century Armenian book of canons Kanonagirq Hayots." (Yerevan: Mesrop Mashtots Institute of Ancient Manuscripts, 2019). Print.





#### LIGR

Class of 2020 | Major Political Science | Faculty Supervisor Anna Lunn

## RESEARCH AND EMPIRICAL ANALYSIS OF LABOR MIGRATION

I conducted research on policies, laws, and realities that shape migration in sending countries (India, Nepal, Pakistan, Sri Lanka, Bangladesh, the Philippines) and GCC receiving countries. For the GCC, I focused on researching workforce nationalization policies in different countries and their impact on the demand for migrant labor as well as laws regulating the working conditions of migrant workers. For sending countries, I conducted research pertaining to regulations that govern recruitment of migrant labor, initiatives to facilitate greater remittances, services provided to families of migrant workers who remain in their country, policies regulating the migration of women specifically, training and orientation programs for migrant workers, and reintegration initiatives for returnees. I used government resources, reports by the ILO, academic papers, and newspaper articles for my research. I then compiled my research into a 30-page paper that will make up the introductory chapter of the book being written by my supervisor which will explain the findings of numerous field research projects carried out by the research team in several countries.



#### UGR

Class of 2019 | Major Social Research and Public Policy Faculty Supervisor John O'Brien



## THE YOUNG EXPAT: THE DEVELOPMENT OF EXPATRIATE ADOLESCENCE IN THE UAE

The stories of young expatriates, those who emigrate with their families to the UAE is a complex one. However, it is narrative often assumed or set-aside. This project offered integral insight by understanding the nuances in the individual stories of young foreign nationals living in the UAE. The research explored whether, how, and to what extent the intersection of an expatriate way of living – contained within expectations about what it means to a 'good' expat – conflicts with a unique adolescent experience. I term this social phenomenon as 'Expatriate Adolescence.' Given the changing ethnoscape of this country, there is much variance in the degree to which the young expatriates experience a 'curated' adolescent life here. Thus, these students toil with the central question of how they must now come to navigate their new home in Abu Dhabi - be it social, familial or cultural, what unique challenges does this populace encounter?



#### UGR

Class of 2020 Major Social Research and Public Policy Faculty Supervisor John O'Brien



## BODIES IN DIFFERENCE: THE LIVED EXPERIENCE OF DISABILITIES IN THE UAF

This ethnographic research aimed to critically inquire into the implementation of policies serving people with disabilities (people of determination) in the UAE. It adopted a medical anthropology perspective in analyzing the lived experience of people of determination to address the question: what role does public policy play in the lived experience of persons with disabilities in the UAE? It explores the lives and choices of these people in social and cultural settings by narrating firsthand accounts of what illness (disability) looks like, how it is felt and embodied, and how it manifests in spaces that are governed by the laws and policies of the country. Drawing on a range of illness narratives, the study viewed disability policies in the UAE from an emic anthropological perspective, with the aim of having a holistic, qualitative and people-based approach to analyzing public policy which treats people as people, and not mere numbers.



#### **JOHN O'BRIEN**

Assistant Professor of Social Research and Public Policy, NYU Abu Dhabi

The Summer Undergraduate Research Program at NYUAD is essential for both faculty and students in the social sciences. While faculty receive important assistance with ongoing projects, students get firsthand experience with research design, data collection and analysis, and research-oriented writing. These acquired skills help prepare students for senior Capstone projects, as well as research work in graduate school or jobs in the NGO, policy, or government sectors.



64 INTERDISCIPLINARY PROJECTS INTERDISCIPLINARY PROJECTS 65

**GUILLERMO SCHLAMP** SION HAU TATIANA HOUHOU MAHER ASFOUR JIMOH YUSUF **ULJAD BERDICA ROBA OLANA YEJI KWON** MARIAM ELSAHHAR FELICIA **ANNAN-MILLS GRACE GU** HANEEN FATHY **KRISTOS BAFFOUR RAY HSU TULEEN SIHABI** YUJEONG OH **INGIE BAHO** 

#### JGR

Faculty Supervisors Rafael Song, Mazin Magzoub, Andras Gyorgy, Alan Healy, Ibrahim Chehade, Ashley Isaac, Esteban Salvemini

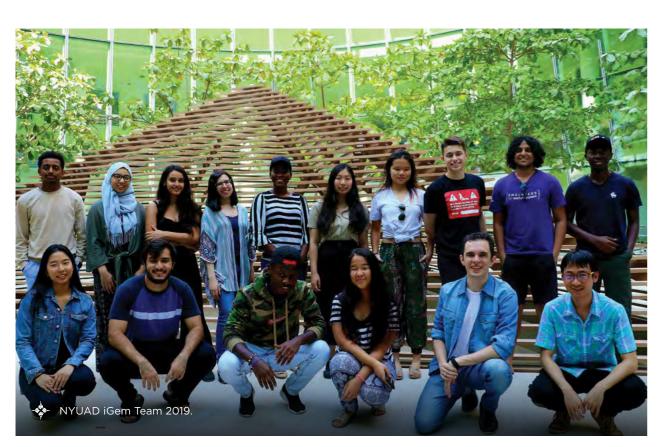
#### NYUAD IGEM 2019

The NYUAD iGEM 2019 team is an interdisciplinary team of students and advisors developing a bacterial pathogen detection device using human saliva specimen.

The device is targeted at travel clearance checkpoints such as airports to prevent international infectious disease outbreaks.

Using a combination of RPA and CRISPR technologies, we hope to successfully diagnose contagions that could be carried and transmitted by unsuspecting passengers. As international air travel becomes more accessible and frequent, the risk of international outbreak increases.

Our device, Volatect, will create a safeguard by providing a sensitive, rapid and non-invasive solution to identify disease carriers with a simple saliva sample. Results from the device will be swiftly and seamlessly communicated between airports and health institutions through a web API to provide the data necessary for immediate action on disease positive cases. We believe this is the first step in making air travel faster and safer, preventing global outbreaks and increasing the efficiency of international responses to pandemics.



#### **IBRAHIM CHEHADE**

Instructor of Biology, NYU Abu Dhabi

The iGEM program is a great platform that allows the students to integrate their aspirations from their respective disciplines into a final research project that benefits and advances the scientific community. Having our students dedicate their summer holidays to the project provides them with the opportunity to work together in the presence of abundant resources and faculty support which places them in the best position to succeed.

#### PPTP

Major Arab Crossroads Studies | Faculty Supervisor Elham Fakhro

## CONSTITUTIONAL DEVELOPMENT IN THE GULF COOPERATION COUNCIL STATES

The six states of the Gulf Cooperation Council (the "GCC") are undergoing profound economic and social changes. Typically described as "rentier states", scholars have believed that the prevalence of oil wealth in these states created a unique social contract in which governments could remain autonomous from civil society, in exchange for bestowing citizens with extensive welfare benefits. While this model was partially accurate in describing the nature of some state-society relations during the late decades of the 20th century, its applicability is increasingly called into question in the face of new economic challenges, demographic pressures, and growing calls by civil society for increased political participation. Despite the significance of constitutions in setting out the foundations of state authority, and in organizing the scope of state power, there are few studies dedicated to understanding the role, and significance of constitutions in the GCC states. In this context, I worked with Professor Fakhro on the preparation for an edited volume on the constitutional history of the GCC. The research tries to understand how constitutional texts have played a role as social, legal, and political instruments, and how they have helped form the social contract in this oil-rich region.

## CARL ALEXANDER BURLIN



#### PPTP

Major Literature and Creative Writing | Faculty Supervisor Robert Parthesius

#### ROLE OF COMMUNITY PARTICIPATION/ CIVIL SCIENCE IN THE RECORDING AND INTERPRETATION OF THE HERITAGE LANDSCAPE IN THE UAE

As a part of figuring out Dhakira Center's next steps and integration in the field of heritage in the UAE, we have researched methods of community participation in heritage studies. We started by trying to understand people's engagement with heritage in the UAE through interviews and surveys and based on the general responses we brainstormed the best methods to increase community participation. We studied different projects that have been employed globally to increase community engagement with heritage and the steps that would be needed to employ them in the UAE through Dhakira Center.







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## ANNA





#### SAMER (SIMPLIFICATION OF ARABIC MASTERPIECES FOR EXTENSIVE READING)

This project brought together researchers in Arabic pedagogy, literature, and NLP in order to build a corpus of curricular readings in Arabic; formulate data-driven guidelines and models for simplification, and use them to guide the simplification of a collection of novels. By the end of the project, we had a sizeable corpus in Arabic based on K12 curricula, a fiction corpus of original and simplified novels, in addition to a graded reader scale and a suite of computational tools (simplification framework and reading-level identification system). I worked on building a database of Arabic words with their readability levels, synonyms and sentiments from various sources with the help of NLP tools developed by the CAMeL lab. I was also responsible for completing and enriching the functionalities of the SAMER interface.



The population of grown-up congenital heart disease (GUCH) patients is increasing as more children with congenital heart disease reach adulthood due to the improving therapeutic interventions. With aging further health issues, underlying comorbidities may occur in GUCH patients, making their medical care even more challenging. Our goal was to investigate potential comorbidities and exercise test (ET) parameters of GUCH patients and compare them to healthy individuals. We furthermore aimed to look at the effects of the simultaneously present chronic diseases on the ET performance of GUCH patients. The findings confirmed that GUCH patients have poorer performance on ET and recover slower post-exercise. As the risk factor burden among the GUCH population is significantly lower we concluded that the reduced exercise tolerance is primarily due to the complex anatomy and physiology of their underlying cardiac disease. Not all GUCH patients require the same level of expertise but specialized care is crucial in order to provide optimal medical treatment; maintain quality of life and extend life expectancy.



#### **MARGARITA** BICEC



UGR

Class of 2020 | Major Computer Science

Faculty Supervisors Nizar Habash and Muhamed Al-Khalil

Major Music and Economics | Faculty Supervisor Nizar Habash

#### LAURA 🗼 Major Economics Finance and Computer Science | Faculty Supervisor Yaw Nyarko



#### AN INTERACTIVE HUMAN AVATAR DIALOGUE SYSTEM: TOIA

This project presented a bilingual (Arabic-English) interactive human avatar dialogue system named TOIA (time-offset interaction application), which simulates face-to-face conversations between humans and digital human avatars recorded in the past. TOIA is similar to a conversational agent, or chatbot, but differs in that it is based on an actual human being and can be used to preserve and tell stories. The system is designed to allow anybody, simply using a laptop, to create an avatar of themselves, thus facilitating cross-cultural and cross-generational sharing of narratives to wider audiences.

#### MATLAB ALGORITHMS ILLUSTRATING CONCEPTS FROM GRAPH THEORY AND GAME THEORY

My PPTP project connected the fields of economics and computer science. The research project involves working on MATLAB algorithms illustrating the concepts from graph theory and game theory. Both graph theory and game theory deal with the ideas that initially may sound a bit abstract - the algorithms I worked on provide us with the opportunity to visualize and hence, to better understand these intricate concepts. The examples of the programs that are part of my research project include: computing pure or mixed strategy Nash equilibria, finding Pareto optimal solutions, calculating the betweenness or building a Watts-Strogatz small-world graph.





Class of 2021 | Major Psychology and Computer Science Faculty Supervisors Olivia Cheung and Michail Maniatakos

#### INVESTIGATION OF VISUAL AND CONCEPTUAL INFLUENCES ON RECOGNITION OF FACES AND OBJECTS AND BACKDOOR SUPRESSION IN FACIAL RECOGNITION NEURAL NETWORK

An important step towards understanding the mechanisms in human visual recognition consists of characterizing the observers' ability to effectively use various types of information for recognition. The purpose of this project was to better understand how mental and neural representations for objects and people is influenced by multiple sources of visual and conceptual information. Machine learning has reached a wide spectrum of applications, including speech recognition, object identification and financial services. With an outsourced supply chain, users may receive a backdoored model, which behaves maliciously in the presence of a unique trigger. We proposed a methodology for suppressing such backdoors without any knowledge about the backdoor or the model.









It is an incredible and invaluable experience for students to present original research from their Capstone projects at international conferences, where they are often surrounded by experts in the field. Students are able to develop their presentation and networking skills, learn the importance of communicating research findings to a wide audience, and often realize their ability to contribute new knowledge to the field.

# CONFERENCE PRESENTATIONS



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June 16-20, Harvard-MIT Broad Institute Cambridge, Massachusetts, United States

#### **GAPSUMMIT 2019**

I attended the GapSummit 2019 at the Harvard-MIT Broad Institute at Cambridge, Massachusetts. This is a student-run, intergenerational, world-class biotech leadership summit with the core objective to discuss pressing challenges to the bio-economy and catalyze innovation to solve those challenges. I was competitively selected as one of the 100 Leaders of Tomorrow (LoT) and participated in the Voices of Tomorrow (VoT), a bioinnovation competition. My team, NanoP, composed of graduate students and postdocs from five universities and five countries, was selected as one of the finalists. As such, we presented our innovative solution for a drug delivery technology to cross the blood-brain-barrier and revolutionize the future of neurotherapeutics at the GapSummit, to an esteemed judge panel and an audience of LoTs, CEOs from the Boston area, and leading experts in the biotech field.

I am inspired and empowered, I learned a lot, and I cannot be more grateful to have attended GapSummit. It was definitely one of the most transformative experiences of my life.

Firstly, I got to listen to lectures and panel discussions from top people in the field. Some examples include Magdalena Skipper, the editor-in-chief of *Nature*, Phil Sharp, the 1993 Nobel Laureate who discovered RNA splicing, Jason Kelly, the CEO of Gingko Bioworks, one of the fastest-growing biotechs that is revolutionizing industrial biology, and David Altshuler, the CSO of Vertex Pharmaceuticals. The program included discussions on eight 'gaps' in biotech, including biosecurity and bioethics, bench to market, and global bioeconomies. I gained an incredibly valuable insight into the biotech industry, and the value of translating academic research into advancements to human health.

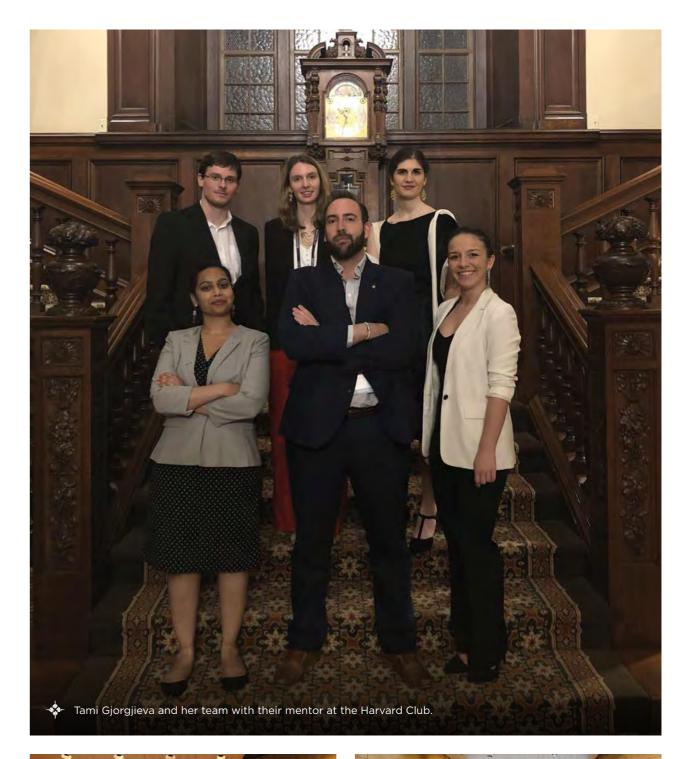
Secondly, I advanced my knowledge in business through the VoT competition. As someone with no experience in business, I had a steep learning curve, but also extracted great value from participating in the competition. My team and I were working on our project for the four months preceding the conference, supported by mentors experienced in intellectual property law, commercialization, early finance, and business strategy. I have learned a lot about translating academic research into commercializable technologies that can advance human health, and how to do a start-up.

Thirdly, and most valuably of all, I entered an incredible network of PhD students, postdocs, young enterpreneurs and innovators, all united by a genuine love for biomedical science and eagerness to transform the future of biotech. Most inspiring to me was the fact that, as one of the few undergraduates selected to attend the Summit, I was surrounded by LoT's who were on average five years ahead of me in terms of their career paths. This gave me a great insight into the opportunities available after NYUAD, and I also learned some valuable lessons from very early on.

Lastly, this whole experience was to me a sort of epiphany - it reminded me why I fell in love with science and why I want to pursue a career in the space of biomedical sciences and genetics, made me even more excited about the research that I am pursuing next year as an NYUAD Research Fellow, and lastly, it inspired me to work hard this summer on my PhD applications.

I hope to continue my involvement with the GapSummit, as well as share the lessons that I have learned with the NYUAD community. Firstly, I will be serving as a Regional Ambassador for the UAE and the Middle East for GapSummit 2020, to take place at Cambridge, UK. I sincerely hope that another NYUAD student can have the opportunity to attend the Summit next year. Secondly, I will be connecting with the Career Development Center about hosting a workshop for careers in biotech in the fall. I had realized that there is little awareness on campus about the opportunities for STEM majors in industry, as an alternative to academia. Therefore, I hope to share what I have learned. Thirdly, I had made a connection with the codirector of MIT Hacking Medicine, a hackathon for medical innovation. As the co-founder of the Network for Students in Medicine and Health, and aided with the new connections that I had developed, I will be working with a group of NYUAD students to bring MIT Hacking Medicine to NYUAD in March 2020.

In summary, GapSummit 2019 was an incredible experience: I learned a lot, I grew a lot, and I am taking active steps to share what I have learned with the NYUAD community. For that, I thank the Office of Undergraduate Research for the conference grant - I would not have been able to take this opportunity otherwise.







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July 21-25 Manchester, United Kingdom

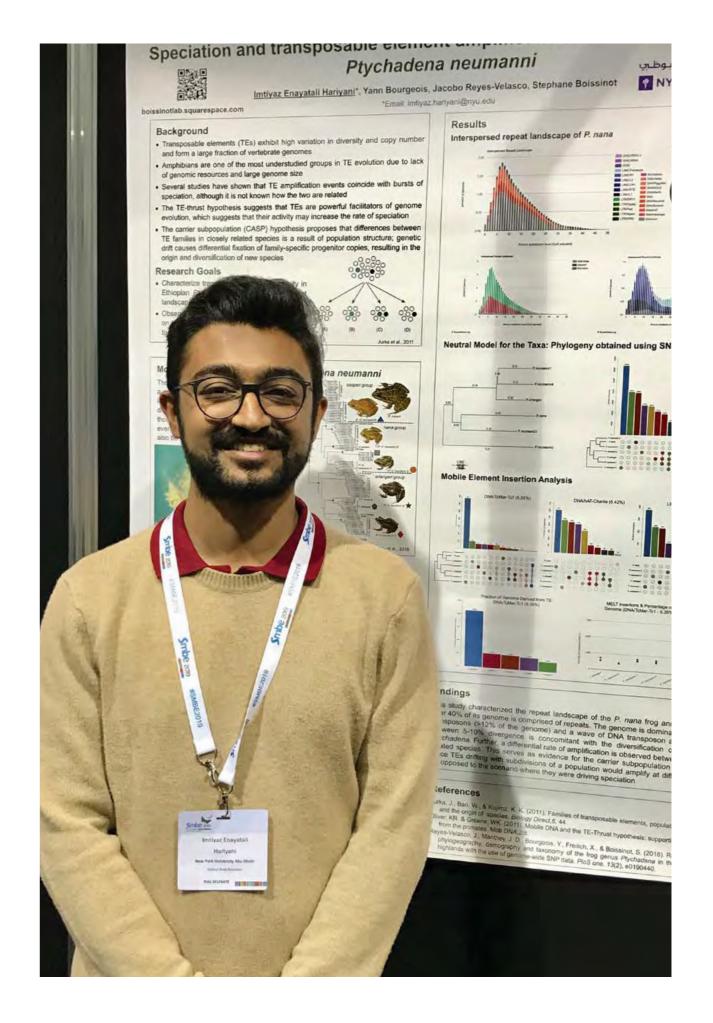
### SOCIETY FOR MOLECULAR BIOLOGY AND EVOLUTION MEETING 2019

The Society for Molecular Biology and Evolution (SMBE) Meeting 2019 was an opportunity for evolutionary biologists to come together and present their research in the form of oral and poster presentations, as well as through informal networking. Over the four day conference organized in Manchester, a number of talks and seminars were held and a wide range of topics from molecular and genome evolution to evolutionary ecology were discussed. These talks greatly enhanced my understanding of concepts in evolutionary biology and population genetics, and helped me learn about the breadth of research being undertaken in the field. Having attended the conference, I was particularly intrigued by the number of potential trajectories my own research at NYUAD can take, as I transition into a full-time opportunity with the Evolutionary Genomics Lab at NYUAD as research assistant this year.

Two poster sessions were held as part of the SMBE meeting, and I was invited to present my poster under the Open Symposium. My project was an extension of my Capstone thesis, which I continued under the Post-graduation Practical Training Program (PPTP) after graduating from NYUAD earlier in May. With a keen interest in genomics and bioinformatics, I looked at a group of closely related frog species from the Ethioipian Highlands to study the speciation process and understand how the *Ptychadena* genus diversified in Africa. Repetitive DNA sequences called transposable elements (TEs) form a large part of vertebrate genomes and their amplification in the genome has been linked to speciation. My goal was to understand how TE amplification and speciation are related by observing patterns of TE insertions in these Ethiopian frogs. Many researchers came up to my poster as I presented my project, and I was provided with a lot of feedback in terms of the implications of my results and possible next steps. It was also a great platform to share my own methodology with others conducting research on transposable elements, helping them identify tools to locate mobile element insertions. Of particular interest to me was a tool designed by a fellow presenter at the conference, which can be used to detect transposable element expression using RNA-seq data. Comparing TE expression levels between closely related frog species using transcriptome data could be a potential next step to further our understanding of speciation and TE amplification.

As an aspiring researcher in evolutionary genomics, I was honored to receive the 'Best Poster Award' in the undergraduate category. The conference was also a great opportunity to meet with researchers in the field who are involved in similar work on transposable elements. Not only did this help me identify potential labs I could apply to for graduate school, but also possibly get involved in collaborative efforts in the future. I am extremely grateful to the NYUAD Office of Undergraduate Research and Professor. Stephane Boissinot for facilitating this research and for allowing me to present my work at such a prestigious platform as SMBE.





CONFERENCE PRESENTATIONS



#### DIRECTOR OF RED IS THE BLOOD OF THE PEOPLE

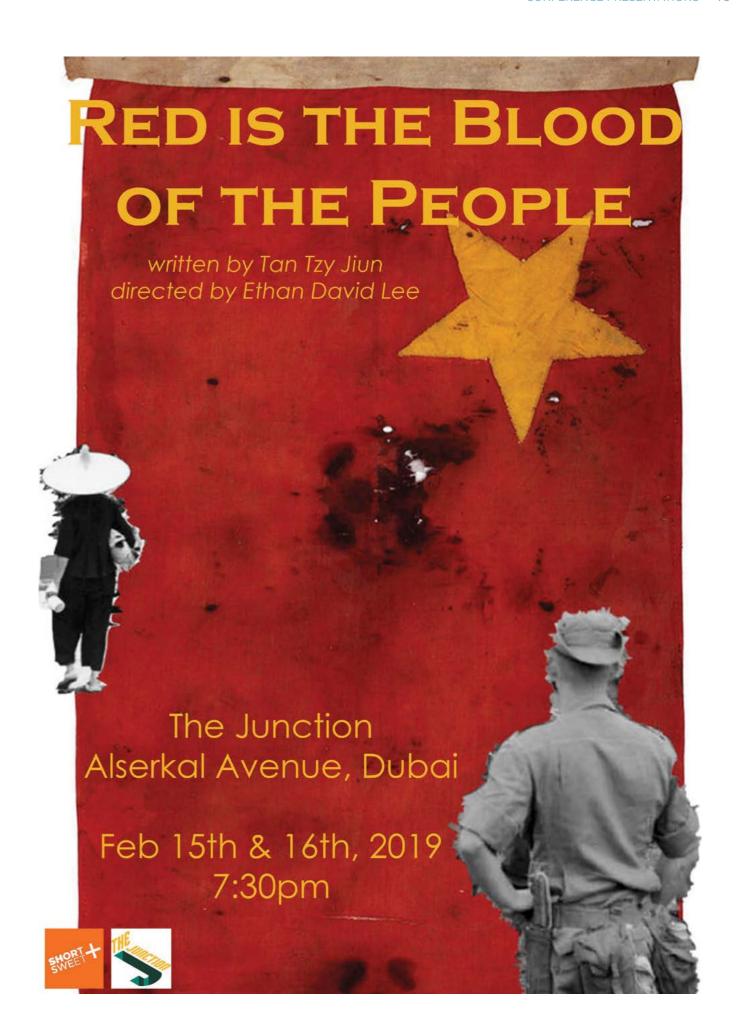
The first rendition of the project was presented at 'Short+Sweet Abu Dhabi' in January 2019 and won awards for Best Script, Best Director, Best Production, and People's Choice. The production was then reworked for 'Short+Sweet Dubai' in February 2019.

A piece of Malaysia's nation-building history, Red is the Blood of the People is an attempt to reopen the wounds of colonial trauma, to make sense of how power continues to operate in historical narratives, and to understand, as descendants of colonised bodies, why the ghosts of our ancestors will continue to haunt us. The show is also inspired by classical epic storytelling. Written in spoken-word poetry style, performed by fragmented voices, we aim to tell a story of one in multiples, and multiples in one. Red is the Blood of the People is a 10-minute play, telling the true story of British Colonization and Japanese Occupation in Malaysia.

This has been a passion project for me, trying to show history in a way that is meaningful and impactful on an audience, and I plan to continue working with contemporary plays that deal with post-colonial history through my academic and professional career.

The project was created in collaboration with undergraduate student Tan Tzy Jiun, who wrote the script. The script is an accumulation of her work in history and creative writing. As the Director, my role was to bring the history to life in the form of a play. Tan Tzy Jiun was advised by Professor David Ludden in New York through her research of Malaysian History and the transformation of that history into artistic text. I was supported by Prof. Tomi Tsunoda through the directing and rehearsal process. Furthermore, Professor Joanna Settle gave feedback on the production.

Jiun and I are asking how we can use history to change the future and being able to present our creative piece in settings like these allows us to obtain feedback from our audience and professional judges. The festival also offers an opportunity to be recognised for our work (through awards) and establish professional connections that will allow us to tell this story to a wider audience in the future.





The Visiting Undergraduate Research Program is a winwin situation for students and faculty. The program has allowed undergraduate students to get immersed in the world of research and bring a fresh viewpoint and approach to ongoing research being conducted. The diversity and different academic background of the students spark creativity and innovation into the research projects they work on.



# VISITING UNDERGRADUATE RESEARCH PROGRAM



#### **BORJA GARCÍA DE SOTO**

Assistant Professor of Civil and Urban Engineering; Director, S.M.A.R.T. Construction Research Group, NYU Abu Dhabi; Global Network Assistant Professor of Civil and Urban Engineering, Tandon School of Engineering, NYU New York

Class of 2020 | NYU Shanghai | Faculty Supervisor Mohamad Eid

Class of 2019 | United Arab Emirates University | Faculty Supervisor John Burt

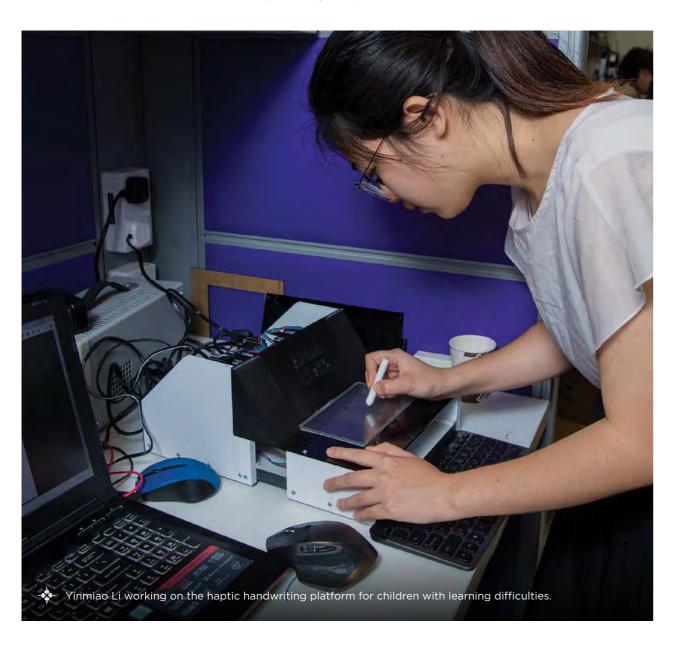




#### HAPTIC GUIDANCE ON HANDWRITING SKILLS DEVELOPMENT

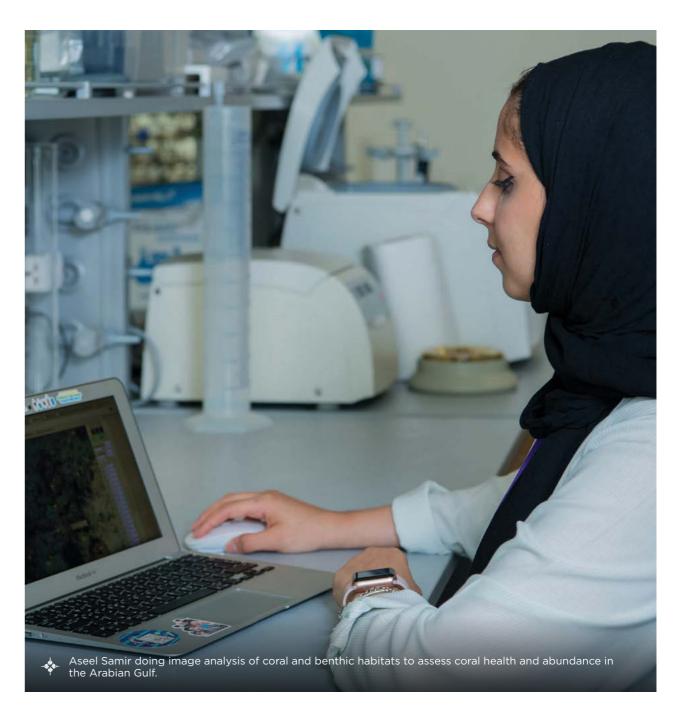
I spent the summer making a software platform for the Haptic Handwriting Guidance research. I was required to use Python and combine the software platform with the hardware platform. The research has given me a lot of opportunities to use different developing tools, coding languages and hardware designs. During this research, I got to understand the process of designing software, from algorithm to the graphical interface. It is a practice of what I have learned from my major. It is also an opportunity for me to learn something new, something from other fields.

Other than the knowledge I earned from this research, the friendly environment of the lab also makes this research an unforgettable experience. I learned a lot from asking the members of the lab. I also saw a lot of group collaboration as well, which taught me how to divide the work and how to collaborate. Overall, this has been a very meaningful experience.



#### MONITORING CHANGES IN CORAL COMMUNITIES ON ABU DHABI REFES

The NYU Abu Dhabi Marine Biology Laboratory, headed by Associate Professor of Biology John Burt, has a longstanding collaboration with the Environment Agency Abu Dhabi to monitor and track changes in coral communities in the emirate. As part of this research project, I was trained on the process of identifying corals and performed analyses of several years worth of underwater monitoring images. My work showed that there has been dramatic changes in the condition of Abu Dhabi coral reefs in recent years as a result of a bleaching event precipitated by an unusually hot summer in 2017, and that there has been limited recovery in subsequent years. These important data will be incorporated into the long-term dataset (now a decade long) and will serve as a baseline against which future recovery will be assessed.



## **AMRO**



Class of 2020 | United Arab Emirates University Faculty Supervisor Serdal Kirmizialtin

#### COMPUTATIONAL MODELING OF GAS AND LIQUID SEPARATIONS

This project involved setting up a virtual box that serves the purpose of simulating a physical experiment, namely fluid separation. We started off with a MOF membrane centralized in our box and methane molecules on either side of that membrane. We then observed the number of molecules that are needed to completely saturate this membrane and record the time for it to occur. The next step of this project was focused on milestoning. This is a process where we segment a long process into intermediate steps and fill in what's in between those steps using another method of simulation. The research has been exceptional in the sense of the exposure I received about the power of computation in science and how it will drastically transform the way we perform our experiments in the near future. I was fortunate enough to learn how to deal with a Linux OS and to code in bash and python script. I also understood the types of errors and dilemmas that a computationalist suffers during research is not as easy as I first imagined.





#### FEASIBILITY STUDY ON HYDROGEL PATTERNING WITH CELLS

The goal of my research was to analyze how the microenvironment affects the mechanobiology of T-cells. I did this by culturing T-cells on hydrogels with different stiffness' to analyze proliferation patterns. The analysis from this experiment can be applied to biomedical engineering and immunotherapy in the future. The research I worked on has been extremely fascinating and intriguing. I learned so much in such a short amount of time. This program was extremely meaningful to me because by the end of it I realized that my true passion is to go into research post-graduation.







Class of 2021 | NYU Shanghai | Faculty Supervisor Antje Von Suchodoletz

#### LET'S READ TOGETHER: HOW MOTHERS AND THEIR TODDLERS TALK ABOUT BOOKS AND COME TO A JOINT FOCUS OF ATTENTION

My main task was to complete the video transcripts of all the Chinese data and code them using two coding systems; one is about socialization goals, the other is about teaching and learning. The most exciting and challenging part of this role has been making reliable decisions whilst taking into account the cultural context and sensitivities. Working on this project has made me more aware of the importance of cultural difference when reviewing and transcribing data.



#### ANTJE VON SUCHODOLETZ

Assistant Professor of Psychology, NYU Abu Dhabi

The Visiting Undergraduate Research Program is an excellent opportunity for involving students in research projects. In our cross-cultural research on mothers' socialization goals for their young children, it was extremely helpful to have a native speaker from China who is not only fluent in the language of the participants in our study but also brings the cultural understanding of behaviors, beliefs, and values. Shumei's knowledge of the local practices helped to implement the coding procedures in a culturally sensitive and culturally appropriate manner while still following a standardized manual. Without Shumei's assistance in and support of the transcribing and coding process it would not have been possible to compare the data from China with data from other countries, including the US, Germany, and India, and identify similarities and differences in mothers' goals for their children's development.

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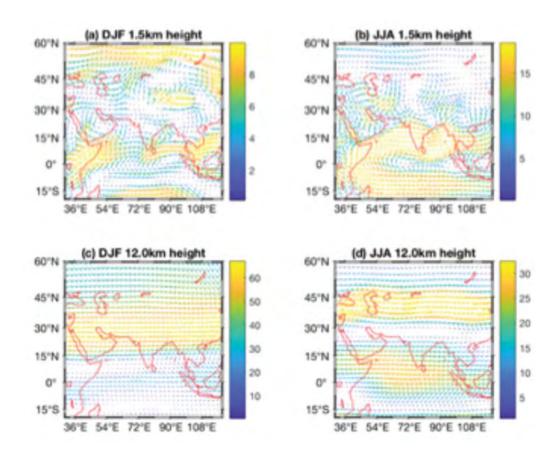


Class of 2019 | United Arab Emirates University Faculty Supervisor Ajaya Ravindran

#### IDENTIFYING THE SUMMER AND WINTER CIRCULATION FEATURES OVER THE ARABIAN PENINSULA AND THE IMPACT OF EL NINO/LA NINA ON THE WINTER CIRCULATION

My research focused on wind circulation over the Arabian Peninsula. I used the monthly mean datasets of u-wind and v-wind from the NOAA Earth System Research Laboratory to analyze wind circulation features. I wrote a function in Matlab to compute, and plot long term mean, and seasonal mean for winter (DJF), and summer (JJA) at two different levels: low and high. Each season has a different circulation of wind, consecutively, causing different weather changes for each season. I then created a function to calculate and plot wind time series during winter using area average and anomalies. According to the definition of El Nino, El Nino years are supposed to have a positive wind speed indicating that the observed wind was warmer than the baseline. La Nina years are supposed to have a negative wind speed indicating that the observed wind was colder than the baseline. I used the historical data of El Nino and La Nina episodes provided by Climate Prediction Center to classify the years in the Niño 3.4 region to El Nino and La Nina years for both seasons ( $> \pm 1$ ).

NYU Abu Dhabi has provided me with a valuable research experience. I learned a lot about climate change, more specifically, wind circulation over the Arabian Peninsula. I found it very interesting to apply what I learned through programming and mathematics classes, and to apply this to real life problems. I would recommend to all students interested in research and academia across the region to apply for the Visiting Undergraduate Research Program.









Class of 2020 | NYU New York | Faculty Supervisor Pance Naumov

#### SMART MATERIALS

My research project focused on two compounds known as ROY and HCB. ROY is one of the most polymorphic compounds known today, meaning it can crystallize in several different forms such as prisms and needles. What is especially interesting about ROY is that seven of its known polymorphs are all stable at room temperature and standard pressure. Thus, getting ROY to crystallize a specific polymorph under a certain set of conditions has been a challenge for chemists. My specific project aimed to characterize the crystallization of ROY on HCB, which is another crystal. The guiding question was whether certain polymorphs of ROY selectively crystallize on specific faces of the HCB crystal. In other words, we hope to characterize the face-dependent crystallization of ROY on HCB. Understanding how to selectively crystallize certain polymorphs of ROY can further our understanding of how polymorphs behave and nucleate, as well as can eventually help us fine-tune drugs relying on the stability of a specific polymorph.

This experience has pushed my capacity for critical thinking and patience to the limit. Dealing with confusing and, at times, frustrating results in the lab is an experience all individuals with an interest in research have. I am grateful to have been able to perform my research surrounded by experts in the field of chemistry, situated in one of the up-andcoming research hubs. Doing work I am passionate about while surrounded by the rich and unfamiliar environment of Abu Dhabi was the perfect catalyst for the personal growth I have seen this summer.

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Class of 2019 | American University of Sharjah | Faculty Supervisor Hoda Alkhzaimi

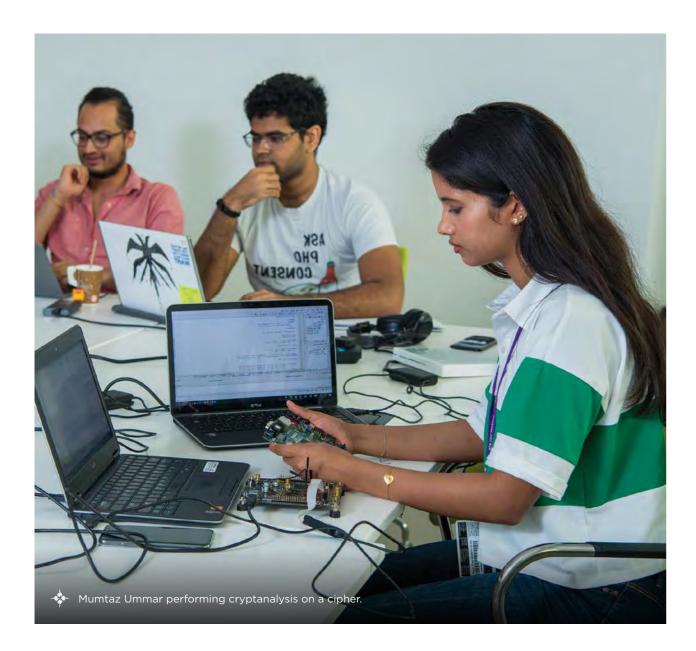
Class of 2020 | American University of Sharjah | Faculty Supervisor Felix Beck





#### CRYPTANALYSIS OF NIST SUBMITTED LIGHTWEIGHT BLOCK CIPHERS

I performed hardware implementations of lightweight block ciphers designed for IOT devices and conducted crypt analysis on them. Specifically, I focused on a power analysis attack using the SAKURA-G board on the "SKINNY" cipher submitted for Round One NIST standardization. This has been a great learning opportunity as I got to enhance my hardware knowledge from a cyber security perspective and also introduced me to how different, research work is from class work. I also obtained a greater understanding of cryptography as I implemented three ciphers on hardware which involved understanding the algorithm and then coding it. Research experience can transform your future and impact your career choices but it is also difficult as we need to constantly come up with new solutions without turning to your professor for help at every obstacle.



#### RESEARCH REPORT ON NYUAD'S WASTE MANAGEMENT

The purpose of the research program was to investigate the waste management of the NYUAD campus and create a report entailing its processes, analytics, and features. During this general inquiry, the position also entailed work in the Precious Plastic Recycling Lab, were we put to use our knowledge and experience with engineering, design, and hands-on craft to enhance the lab and output and spread awareness regarding plastic recycling.

I personally benefited greatly from the experience, both from an engineering and design standpoint, as I was introduced to various new design and construction techniques and software, and from a social standpoint, as I participated and hosted various workshops and talks regarding plastic recycling.

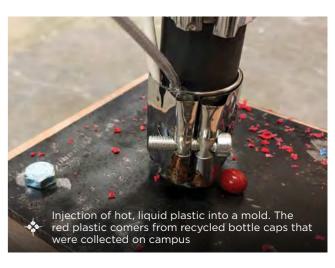
Such practical experience in the workplace is invaluable to students such as myself.



New York University Abu Dhabi's Plastic Recycling Research Lab is an interdisciplinary research lab, set up and led by Professor Felix Beck, with a focus on getting and sharing a holistic view onto global issues that relate to plastic and plastic recycling. Read more about the lab at plastic.international







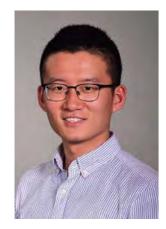




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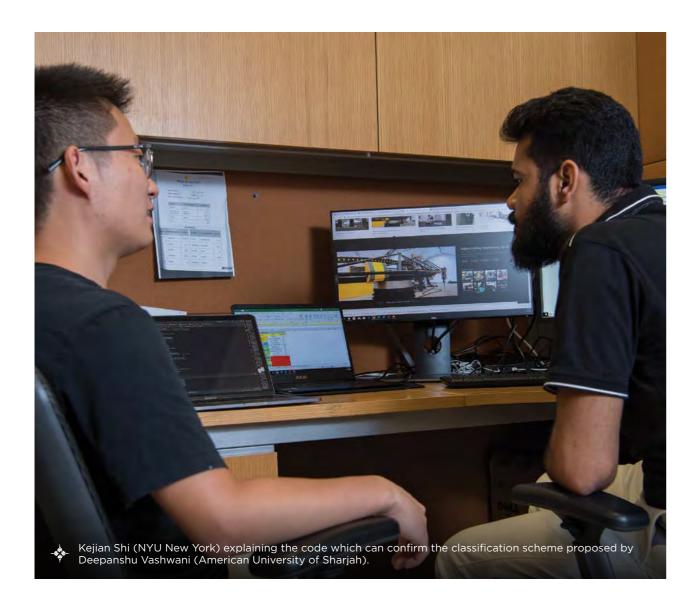
## KEJIAN SHI





#### TRENDS IN 3D CONSTRUCTION PRINTING USING TEXT MINING AND NATURAL LANGUAGE PROCESSING

My research project involved completing an exhaustive literature review using text mining. I developed a program that processes data (conference papers and journal articles) downloaded from Web of Science indexing service. The program extracts useful information such as "country of origin" and outputs to a userfriendly format. It has recognition capability in that it deploys Natural Language Processing techniques to capture syntactics and semantics of each article and map each article to a pre-defined area of research. This enables us to have not only an overview of the research trend of 3D construction printing but also insights into specific research interests and how it has been evolved over time. As a student majoring in computer science, the exposure to civil engineering subjects helped broaden my knowledge and enhanced my ability to study in interdisciplinary subjects. The research experience also improved my academic writing. Moreover, I got to connect with experienced faculty at NYUAD who are always willing to help and started life-long friendships with my colleagues.



#### PARTICIPANTS FROM THE 2019 VISITING UNDERGRADUATE RESEARCH PROGRAM VISITING THE SHEIKH MOHAMMED CENTRE FOR CULTURAL **UNDERSTANDING**











# POST-GRADUATION RESEARCH FELLOWSHIP PROGRAM





#### COVERAGE CONTROL OF COLLABORATING DRONES USING SPHERICAL CAMERAS

Faculty Supervisor Anthony Tzes

This research project aims to improve area coverage control using a swarm of collaborative drones. Each drone will be equipped with a spherical camera that will provide information about its neighboring drones. Rather than relying on a wireless exchange of the geolocation coordinates between each drone, computer vision algorithms will be employed to provide relative localization between the swarm's members. Based on this information, each drone will compute its 3D-Voronoi responsibility cell and adjust its position so as to cover as much area as possible. The research has ample opportunity for practical application in fields ranging from search and rescue to security and defense.



#### TRANSLATION OF SAHAR KHALIFEH'S THE SUNFLOWER

Faculty Supervisor Corinne Stokes

My translation of Sahar Khalifeh's *The Sunflower*, which has never before been translated into English, will include a scholarly introduction that explores issues of translation and translation theory as they are related to the shift from Arabic into English. The introduction will also shed light on the role gender plays in political and cultural resistance movements, and the gender politics of cultural and literary production in the region. Through translating Abbad Al Shams, which addresses the double oppression that Palestinian women live in and compares their situation with other women's situations under conflict, I am expanding the conversation about women's roles, labor, and resistance particularly in conflict and literature.



#### PARCHED AND IMPATIENT: HOW DROUGHT SHAPES POLITICAL **PREFERENCES**

Faculty Supervisor J. Andrew Harris

How do voters respond to drought on election day? By examining the past decade of rainfall and voting records at over 8,000 polling stations across Australia, this study is the first to investigate how voters from drought affected and unaffected locations have comparatively voted in Australian federal elections. With a focus on the 2019 election, field work in Australia will examine how political parties mobilize around providing ways forward from drought and how voters perceive this. By combining quantitative and qualitative methods, this research primarily tests whether elections influenced by climate events act as a wake-up-call for governments to invest in disaster resilience or perpetuate short-term minded management.

#### GENETICS AND LAW IN THE UNITED ARAB EMIRATES

Faculty Supervisors Youssef Idaghdour and John Coughlin

I am pursuing a multidisciplinary research fellowship bridging the fields of human genetics and law. As part of the UAE Healthy Future Study research team, I will be analyzing genetic and clinical data from Emirati volunteers to study the genetic component of cardiovascular disease and diabetes in Abu Dhabi. In my legal research, I will be studying trends of secular genetic legislation worldwide and their translatability into Islamic bioethical and legal doctrine, in order to produce a research-based legislative proposal for the UAE on regulating the future of genomic medicine.





#### (MIS-)MANAGING DISPLACEMENT: TECHNOCRACY, DEVELOPMENT, AND REFUGEE RELIEF IN JORDAN

Faculty Supervisors Nathalie Peutz and Jonathan Shannon

This project looks at the proliferation of exploitative practices within the humanitarian-development industry in Jordan, with a particular focus on the Syrian refugee crisis. In the past six years, the Jordanian refugee regime has become subject to a new degree technocratic governance, as the international response to the Syrian crisis transformed from a short-term humanitarian mission focusing on emergency relief, to a long-term development enterprise centering macroeconomic interventions, empowerment programs, and refugee integration. The turn to development planning has been accompanied by an increase in exploitation, abuse and fraud in the humanitarian-development sector. To understand why this has occurred, and how Syrians and NGO workers deal with cases of «mismanagement,» this project analyzes ethnographic data on experiences of humanitarian and development programming. By doing so, it seeks to shine light both on the localized challenges that Syrian refugees face in the context of protracted displacement in Jordan, and the structural connections between technocracy, humanitarianism and development on the one hand, and exploitation, abuse and refugee management on the other.



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#### THE INTERACTION BETWEEN STRESS AND SLEEP WAKE CYCLE

Faculty Supervisor Dipesh Chaudhury

Since sleep deprivation was first discovered to alleviate depression in ~%50 of endogenous depressives, research has uncovered a tight association between depression and sleep. Notably, the stage of sleep that we call rapid eye movement (REM) has been implicated in both adaptive and maladaptive responses to stress; a duality that called for a comparative study of its role during and after a stressful event. This project compares the role of REM sleep during and after the onset of chronic social defeat stress, using a well-established mouse model of depression. Besides comparing its functionality, this project subsequently manipulates REM sleep in vivo and in real-time to assess if susceptibility to stress can be countered using nothing but the body's own sleep.



#### A STUDY OF THE EFFECT OF SUPERMASSIVE BLACK HOLES ON GALAXY FORMATION

Faculty Supervisor Andrea Valerio Macciò

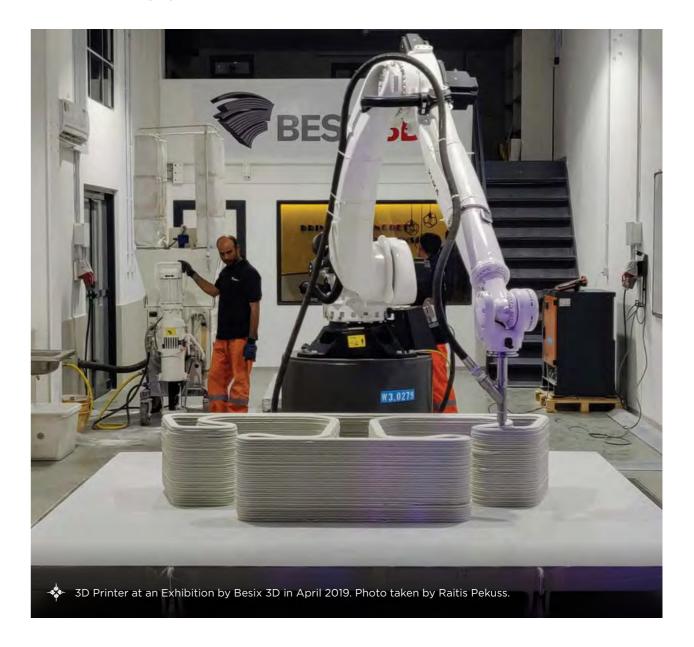
The focus of my project includes researching a theoretical framework to implement and fine-tune a self-consistent analytical model for black hole accretion and blackhole feedback on large galactic scales. This is to be accomplished through computing numerical simulations of galaxy formation and utilizing observational data sets to constraint the model's parameter space. The aims of the project are to probe the interaction between black holes and their host galaxies through investigating black hole-host galaxy scaling relations, and to gain insight regarding the underlying physical processes that give rise to the observed co-evolution of galaxies and their black holes. Thus, this will help improve the understanding of the role black holes play in the formation of the Universe, and in characterizing the relevant parameters that determine their effect on the galaxies formed.

#### PRODUCTIVITY ANALYSIS OF CONSTRUCTION PROJECTS USING 3D PRINTING



Faculty Supervisor Borja García de Soto

The purpose of my study is to quantify the improvement in productivity, defined as cost and time over the accomplished quantity of work, for construction projects that implement additive manufacturing, also referred to as 3D printing. In order to achieve the goal, this research aims to collaborate with industry partners and compare productivities of projects accomplished with and without the use of additive manufacturing techniques. Such a study bears significance for the global market as 3D printing of concrete could optimize parts of the construction industry, provide affordable housing for developing communities, and is also pertinent to the region as Dubai has launched the Dubai 3D Printing Strategy aiming to print 25 per cent of all new buildings by 2030.





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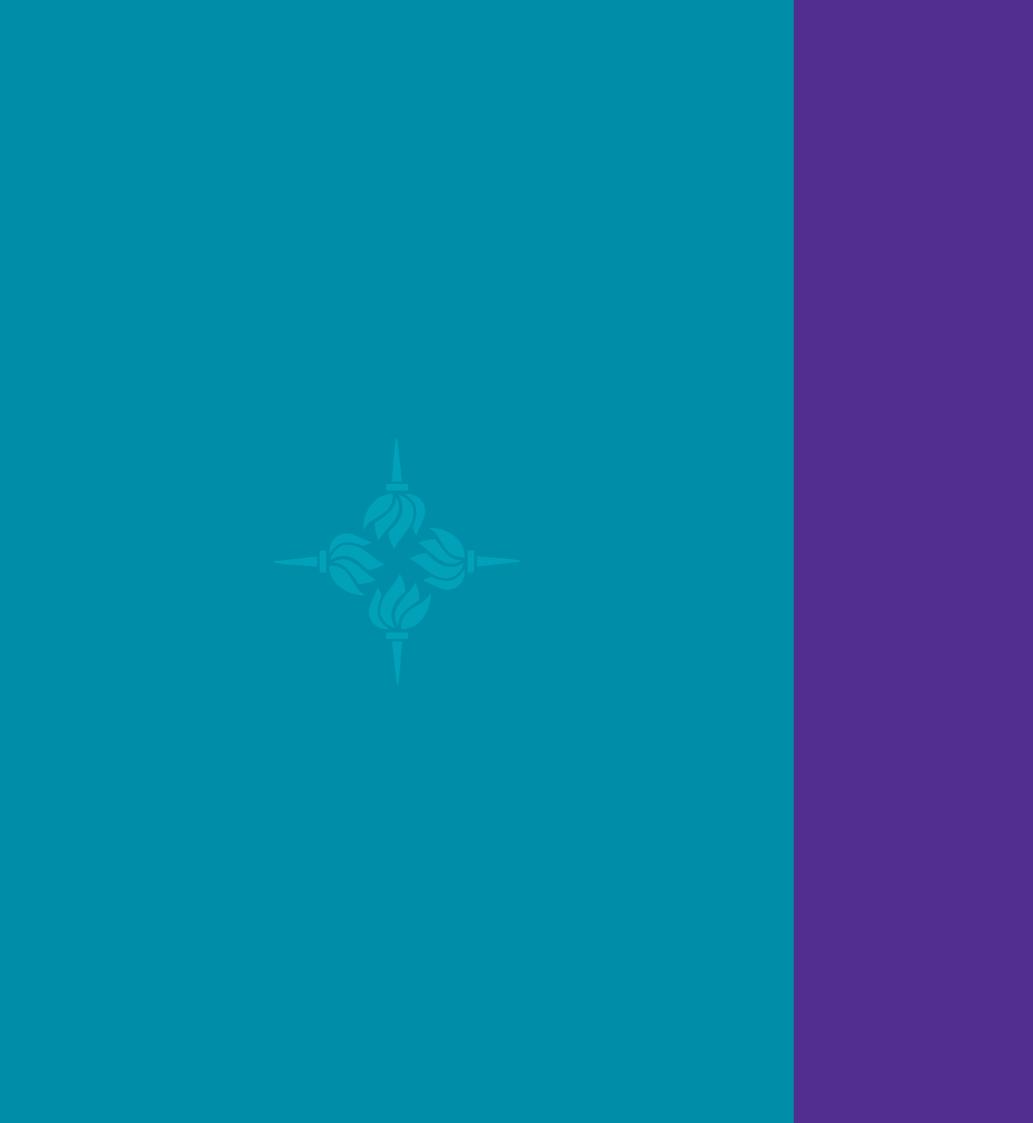
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