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CORNELL UNIVERSITY

Cornell is a small private, Ivy League University and is the land-grant university for New York State. Cornell’s mission is to discover, preserve, and disseminate knowledge; produce creative work; and promote a culture of broad inquiry throughout and beyond the Cornell community. Through public service, Cornell also aims to enhance the lives and livelihoods of our students, the people of New York, and others around the world.

OFFICE OF ACADEMIC DIVERSITY INITIATIVES (OADI)

To ensure that the widest range of life experience, knowledge, creative expression and original thinking is shared across the breadth of Cornell’s students, faculty, staff, and disciplines, particularly by those with backgrounds historically less likely to have been represented on campus. To support the increased presence, academic success, intellectual achievement, and inclusion, across all fields of study, of those from these under-represented backgrounds at Cornell.

RONALD E. MCNAIR SCHOLARS PROGRAM

The McNair Scholars Program prepares qualified undergraduates for entrance to a Ph.D. program in all fields of study. The goals of the program are to increase the number of first-generation, low-income and/or underrepresented students in Ph.D. programs, and ultimately, to diversify the faculty in colleges and universities across the country. The McNair Scholars Program provides undergraduates with opportunities to participate in academic year and summer research activities. McNair Scholars attend courses, seminars and workshops on topics related to graduate school preparation, complete a research project under the guidance of a faculty mentor, and have the opportunity to present their research at local, regional and national conferences.

OADI RESEARCH SCHOLARS PROGRAM (ORSP)

The OADI Research Program provides underrepresented students the opportunity for research-oriented academic preparation in the interpretive social sciences, arts and humanities through coursework, mentoring, and informative events. The program also prepares participants for successful application to prestigious research-based scholarship programs, on campus and beyond. Participants are also prepared to create successful applications to prestigious research-based scholarship programs both on campus and in their future careers.
A letter from the Director
February 28, 2019

We are excited to have the third issue of the OADI Research Compendium (ORC). The purpose of the ORC is to feature research conducted by the Cornell McNair Scholars Program and OADI Research Scholars. Our scholars are expected to research a topic in their field of study and present a developed, scholarly paper at a symposium.

OADI programs provide guidance, mentoring, academic support, research opportunities and other scholarly activities for STEM and Social Science majors. This will assist scholars in their successful transition to graduate study at the doctoral level and to obtain a position as a professor.

We are very proud to feature our undergraduate scholar-leaders from a variety of disciplines at Cornell University. We celebrate the hard work and scholarly research of students within this compendium. I acknowledge all faculty mentors and extend my appreciation to all the administrators for their commitment and effort in guiding our scholars towards success.

This compendium demonstrates the dedication of our campus faculty, staff, and scholars!

Sincerely,

Kristin Dade, M.S Ed., Ph.D.
Associate Director, Office of Academic Diversity Initiatives
Director, Student Success Programs
Director, CSTEP/ McNair Scholars Program

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This compendium contains the abstract component of undergraduate research papers that outline our scholars’ research experiences from summer 2018 to spring 2019.
My summer research experience included the implementation of the Connections Work Group (CWG) in a 4-H Bristol Hills Summer Camp. The purpose of this 6-week long program is to refine practitioners’ ability to identify and seize growth opportunities for youth in the summer camp environment. The members of the work group consisted of 8 camp counselors who were given (1) brief empirical readings that covered a range of Developmental Science topics, and (2) video recorded regularly by project staff during both planned program activities and unstructured time. The group met 2-4 times weekly with Project staff during which participants indulged in an open group review and discussion of one another’s practice clips, as well as reflected on the different practices that may enhance the experiences of the youth. Participants completed pre- and post-surveys assessing their knowledge of key program concepts, perceived effectiveness, and growth mindset regarding the promotion of children’s social and emotional growth, and a test of empathic accuracy. Based on the collected survey data, CWG appears to be a promising staff development program in which practitioners improve their understanding of their roles, as well as their abilities to have meaningful interactions with campers that promote positive youth development. Keywords: 4-H programs, relational development, staff development.

“...
Non-Charged Cell-Penetrating Oligothioetheramides

The plasma membrane of eukaryotic cells is a boundary between the cell and its environment. It regulates the movement of molecules across the cell. Intracellular delivery of larger exogenous molecules such as therapeutic agents is difficult, and therefore novel systems to facilitate their transport. The discovery of Cell penetrating peptides (CPPs) offered a new way for delivering a wide variety of molecular cargoes. CPPs are defined as peptides with 9-30 amino acids which are capable of cellular membrane translocation. Most CPPs have a high content of basic amino acids, resulting in an overall net positive charge. One of such CPPs discovered was the HIV-1 tat protein, which was shown to have its full-length protein cross the cell membrane. Despite their efficiency as cargo transporters there are a lot of drawbacks associated with CPP mediated cargo delivery; mainly their susceptibility to proteolytic degradation, and high chances of immune recognition. Due to these limitations, our research group developed a synthetic approach to develop sequence defined non-charged cell penetrating oligothioetheramides (OligoTEAs) via unique N-allyl acrylamide building blocks. Our OligoTEAs have unique properties which gives them multiple advantages over traditional CPPs as cargo transporters. First, they are abiotic, so they are susceptible to protease degradation. Their synthetic nature gives us access to backbone modifications to enhance cell membrane interactions. Finally, Monomer and sequence diversity provides access to a massive OligoTEA library.

“The McNair Scholars program has presented me with a plethora of opportunities that have allowed me to grow both professionally and personally as a scholar. The program provides the resources I needed to succeed and the support network I needed to challenge myself and become the best scholar I can be.”

~Jaylexia Clark

The Effect of Progranulin on Microglial Signaling and Dynamics

Alzheimer’s Disease (AD) is a neurodegenerative disease that features amyloid beta (Aβ) plaques in the brain. Microglial cells, a type of brain cell, respond to Aβ by phagocytosing the plaques while producing progranulin (PGRN), a secreted glycoprotein of 7.5 granulin repeats implicated in AD. While microglia can play a protective role in AD, they are also highly dynamic and have pro-inflammatory functions, such as pro-inflammatory cytokine secretion and Triggering receptor expressed on myeloid cells 2/TYRO protein tyrosine kinase-binding protein (TREM2/DAP12) signaling. The current study aimed to elucidate PGRN’s role in microglial signaling in AD. Microglial and Aβ pathology, as well as microglial dynamics and recovery, in PGRN deficient mice with an AD background were characterized. Preliminary data shows that there is an increased number of microglia around Aβ plaques in the PGRN deficient AD mice, and that PGRN affects microglial dynamics and recovery after injury. Further study is warranted to determine if PGRN negatively regulates cytokine levels and TREM2/DAP12 signaling to inhibit microglial recruitment in AD.

Nana Antwi
College of Engineering
Cornell University
McNair Scholar 2020
Mentor: Professor Christopher Alabi

Stephanie Becker
College of Agriculture & Life Sciences
Cornell University
McNair & P3 Scholar 2019
Mentor: Professor Fenghua Hu
Record Linking Boston Charter School Data

Seats at Boston charter schools are assigned by lottery. These lotteries are administered independently by each charter school, and before fall 2016 each charter school had its own lottery application. On November 1, 2016, the Boston Charter School Alliance launched an online common application that allows families to apply to several charter schools at once. To investigate the effect of this policy change on the behavior of families applying to charter schools, we need to know: 1) how many students applied to charter schools before and after the policy change and 2) how many charter schools each student applied to before and after the policy change.

Furthermore, we want to know the demographic characteristics of these applicants to identify different effects of the policy across groups. This project uses probabilistic record linkage to match the past three years of Boston charter school applicants (2015-2017) with their State Assigned Student Identifier (SASID), a unique identifier tied to demographic information and testing outcomes. This research can be used to help policy analysts examine the benefits and costs of altering the charter school application process in Boston and many other cities across the nation.

“I have never done research before this experience. With that being said, I want to continue forward with it. This opportunity not only revealed to me the education oath that I want to partake in - Electrical and Computer Engineering - it revealed to me that I do want with my education. I want to get a Ph.D.”

~Atsutse Kludze

What is the Impact of an Increased Digitized Workforce on Labor Standards Compliance and Enforcement Efforts?

First, this paper reviews previous research that discusses how advancements in technology have reshaped the employment process and the American workplace with a focus on three segments of the labor economy, recruitment, hiring, and finally work production as it relates to telework as well as the gig economy. Then the paper shifts to focus on describing what type of impact said shift will have on labor standard compliance. How it relates to labor standard compliance regarding unlawful discrimination against workers based on protected categories as well as enforcement efforts meant to decrease the onslaught of digital discrimination in today’s workplace. To discuss this impact on labor standard compliance the author will use case notes taken while working with the U.S. Equal Employment Opportunity Commission (EEOC) on cases of workplace discrimination. The case notes will provide an in-depth analysis of how the EEOC is working to enforce labor standard compliance in the 21st century American workplace despite the way advancements in technology are working to reshape said workplace. Based on the results it can be argued that the digitization of recruitment, hiring, and even work production as exemplified through telework, have not escaped the enforcement efforts of the EEOC, however these coping methods fail when it comes to the gig economy in this arena technology has not changed the workplace setting but the fundamental employee-employer relationship.
Engineering of sdAb-Functionalized Cornell Prime Dots for Epidermal Growth Factor Receptor Targeting

Cancer is a disease of irregular, uncontrolled cellular division resulting from a combination of mutations in the genetic code of a cell. It is challenging to image the spread of cancer in vivo due to difficulty in distinguishing cancerous tissues from healthy tissues, and a lack of specificity in currently used imaging systems. Here we propose using a dual modality ‘target-or-clear’ PET-optical imaging nanoprobe for the specific targeting of cancerous tissue in an effort to accurately and precisely image the progression of disease in patients. We’ve employed the new generation ultrasmall fluorescent silica nanoparticle, the Cornell Prime Dot (or C’ dot), as our flagship platform for the next generation of imaging probes. In this work, the surface of the C’ dot underwent functionalization with a single domain antibody fragment (sdAb) targeting epidermal growth factor receptor (EGFR) and radiolabeling with 89Zr for the visualization of particle distribution via PET. As-developed, our platform is widely applicable considering that EGFR is an over expressed receptor on many aggressive cancers. EGFR-sdAb functionalized C’ dots were demonstrated to retain their favorable pharmacokinetic profiles, bulk renal excretion, and high stability while specifically targeting EGFR expressing cancer cells both in vitro and in vivo. This tool permits the precise recognition of EGFR and has the potential to serve as a drug delivery vehicle in future work.

“\textit{The Cornell McNair Scholars Program has played an integral part in providing me with the research opportunities, resources, support, and overall guidance to better prepare me to pursue my Ph.D. next fall.}”

~McNair Scholar

Excess Guanine Results in Nucleotide Imbalance to Impair Cancer Cell Proliferation

Nucleotide metabolism is critical for proliferating cells. Nucleoside analogs are important cancer therapies, and excess guanine nucleotides themselves can also be anti-proliferative for cancer cells. Thus, determining how guanine nucleotide treatment changes nucleic acid metabolism to impact cell growth and division can elucidate cancer treatment mechanisms. In this study, we found that guanine and deoxyguanosine treatment inhibits cell proliferation whilst increasing cell size. To investigate the mechanism, we examined how guanine and deoxyguanosine alter nucleotide pools and downstream macromolecule synthesis. Guanine nucleosides deplete intracellular adenylate pools, decreased mTORC1 activity, and activated DNA damage responses. Strikingly, adenine treatment rescued proliferation and the size of guanine nucleoside treated cells. Adenine also rescued effects on cell signaling and restored DNA replication fidelity that was impaired by guanine treatment. Taken together, our data suggests that guanine toxicity can be attributed to nucleotide imbalance, which has downstream effects on the balance between DNA replication and cell growth. These data have implications for understanding how targeting nucleotide metabolism limits or regulates cancer cell growth, providing necessary context to guide clinical treatments.

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College of Engineering
Cornell University
McNair, EOP & First In Class Scholar 2020
Mentor: Professor Ulrich Wiesner

Ryan Elbashir
College of Arts and Sciences
Cornell University
McNair Scholar 2020
Mentors: Professors Frances Diehl & Matthew Vander Heiden
Cobalt (III) Schiff Base Complexes as Cancer Therapeutics Through Proteasome Inhibition

Proteasomal degradation of ubiquitinylated proteins is a mechanism by which cells recycle unneeded or faulty proteins by breaking them down into their constituent amino acids. The upregulation of proteasomal degradation is linked to survival and metastatic processes in cancerous cells of solid tumors, particularly in prostate cancer. This link to cancer has sparked interest in small molecule inhibitors of the 26S proteasome. The 26S proteasome consists of two regulatory “19S” caps and a “20S” proteolytic core. The 20S core contains three active sites, each with different specificities. Proteasome inhibition has seen some success through the organic Bortezomib as a treatment for multiple myeloma and mantle cell lymphoma. In search of proteasome inhibitors for cancers with solid tumors, we’ve begun the development of cobalt(III) schiff base complexes for use as inhibitors of these proteasomal active sites. Octahedral cobalt(III) schiff base complexes have been previously reported as protease inhibitors through axial ligand exchange with histidine residues in their active sites; we hypothesize that similar cobalt(III) complexes can inhibit the proteasome also through axial ligand exchange. These complexes comprise of a schiff base equatorial chelator and two axial ligands. We will modify the electronic properties of the equatorial ligand to influence axial ligand binding. We will also vary axial ligands of different donor strengths, allowing us to easily synthesize and screen multiple complexes of differing electronic properties for proteasome inhibition. Preliminary data suggests that DoxovirTM, of the formula [Co(acacen) (2-MeIm)2]+, is a modest proteasome inhibitor. Screening of other variants is to follow.

Inequality and the Structural Covariates of Homicide

This study investigates the link between inequality and homicide in the context of the post-1970 inequality increase. Research demonstrates that homicide is a function of inequality, yet there was a notable decline in homicide beginning in the 1990s even as economic inequality continued ascending. Did inequality lose its grip on homicide during this period? The analysis begins by identifying change over time across a set of inequality measures for 50 states plus the District of Columbia. Second, aggregate and multivariate relationships are estimated within a model of homicide causation. Findings suggest that states with higher inequality have higher homicide rates, that this relationship persisted since 1977, across the Great Recession and an 84 percent decline in the national homicide rate. The durability of this relationship suggests that inequality is a fundamental component of homicide causation.

~Sabrina Kazi
The Effect of Mating and Juvenile Hormone Exposure on the Immunity of Male Drosophila Melanogaster

The role of Juvenile Hormone (JH) in life-history trade-offs of Drosophila melanogaster is much better understood in females than in males. Previously, we reported endogenous production of JH upon mating in females results in the suppression of immunity. This time, we studied the effects of mating on immunity in males, by analyzing the survival rate of virgin and mated males systemically infected with bacteria of varying virulence. We also exposed virgin and mated males to artificial JH followed by infection with bacterium Providencia rettgeri to assay if JH causes immunosuppression in males as well. We infected flies using a thin needle (0.1mm) which was dipped in fresh bacterial suspension (OD600 = 1) each time a fly was infected (pricked). Data were collected by counting fly survivorship for 96 hours post-infection, with the first set of observations at six hours to estimate fly mortality due to injury rather than infection. Kaplan-Meier plots were constructed using the survivorship data and differences between the treatments were tested using the log-rank test. We found that virgin males survived significantly better than mated males in most of the bacterial infections. Our results from JH exposure showed that males continuously exposed to higher JH levels suffered worse outcomes than unexposed controls and males continuously exposed to lower JH levels. We also found transient exposure to JH to be less reliable in producing outcomes significantly different from controls. We suggest that mating and JH can be immunosuppressive in males as observed in females previously.

The Rights of The Confined: A Look at Access to Health Services for Women in the Prison System of Argentina

The 1970s marked the beginning of a war that would change the trajectory of crime and punishment relations forever: The war on drugs. Commenced by United States President, Richard Nixon, in 1971, the idea of the war was to deter participation in the expanding drug market using policies that placed heavy emphasis on punishment. The years following were characterized by the increase in punitive policies aimed to achieve this goal, thus leading to an unprecedented rise in Incarceration. In Argentina, amongst other Latin American countries, there has been a large increase in the rates of incarceration. As a result, a wealth of studies have attempted to understand both the effectiveness of these policies as well as the long-term effects of this focus on punishment and confinement. Many researchers have attempted to highlight the hypocrisy of the system, pointing out the reality that the system contributes to the inhumane persecution of a population that is often already disadvantaged. However, traditionally, many of these theories have been applied to the struggle of incarcerated men, leaving the topic of the women’s incarceration devastatingly under explored. This project attempts to investigate the complexities of crime and punishment theories by considering the access to health services that women incarcerated in the federal penitentiary system of Argentina have. The study of women incarceration has called attention to the unique place women hold in society, and the long-lasting societal implications of their conditions inside, and the overall rise of their incarceration rates in general. We will discuss how unsafe conditions and neglect of basic health services may prompt another more obscure method of punishment.
Development of a Toddler Picture Rotation Task

The purpose of this study was to develop a mental rotation task, the Toddler PRT, targeted towards children ages 1.5 to 3 years old. The Toddler PRT is conducted on a Microsoft Surface Pro and is generated by the software program PsychoPy. The test stimuli consists of two dimensional pictures of an alligator that are be rotated in the plane. Children are to complete 12 items with one target figure and two comparison figures. Each item has the target image rotated different angles from 0 to 330 degrees. The participants are being recruited from a science education institute. It was hypothesized that, consistent with previous studies, there will be a gender difference with boys having an advantage in quicker and accurate mental rotations. Similarly, it is also expected that toddlers, as they get older, will be able to rotate more and more angles. Even though the study is ongoing, it seems as if having a touch screen and language sensitive PRT task may not be ideal for children at two years of age.

“As a first-generation low-income student, this program has providing my community, my family, and myself with the hope for a better future for generations to come.”
~McNair Scholar

Modeling Photon Scattering Information for Design of A-SPAD Sensors Programs

The objective of this experiment was to effectively characterize an in-lab developed SPAD (single-photon avalanche diode/light sensor). This chip combines both the functionality of a SPAD as well as the functionality of a ASP (pixel, sensor that can detect direction of incident light) into one chip called an Angle-Sensitive SPAD (A-SPAD). A-SPADs will be important in today’s world as they identify light into usable information. In this case, A-SPADs can detect the slightest discrepancies within materials/substances (such as tissue or skin) when in use. Should the research be successful, the improved A-SPADs or knowledge will increase the effectiveness and accuracy of 3D data collection without increasing cost and without the limitations of lens. The chip will be accurately characterized in part by observing it under various light levels and situations. Furthermore, because of this planned characterization, this experiment will also involve preparing a printed circuit board (PCB) for characterization. However, the PCB Design and testing part of the experiment is an on-going research project during the Fall 2018 Semester at Cornell University. During the summer of 2018 this experiment was focused on understanding and analyzing visible light photons behavior. This part of the experiment simulated the scattering of photons with a program that measures, through Monte Carlo Simulation, where the photons have exited based on the (x,y,z) coordinates and angle (Φ, θ) on a unit cube. Since it is not possible to collect all information about angles and locations, as the simulation does, the devices built can only collect information about a small range of angles, and at the cost of spatial resolution. These simulations helped reveal what the right combination of subset data is most relevant when identifying structures. Results suggest that although the exit points of photons are erratic, they regardless have a clear and visible response to any obstruction in their path. This observation allowed us to see what factor may affect the data collected by the A-SPAD, therefore see how accurately the A-SPAD can collect photon data.
**Electrodeposition of Metals in Structured Porous Media**

As future technology emerges that relies on more powerful and portable energy sources, there is a consumer and industrial demand for more efficient energy storage. Lithium-Metal Batteries (LMB’s) are promising candidates for such light-weight and high-energy density secondary energy sources, laptops. However, after repeated cycles of charging and discharging, LMB’s will unpredictably short-circuit, ruining the battery, and in some cases combust. Although there is exhaustive and continuing research regarding suppression of these dendrites by modifications of the electrolyte/separator, there is little research into how these dendrites initially nucleate and subsequently grow. The objective of this project is to perform in-situ nucleation and growth of dendrites in electrolyte of different composition and separators of different porosity/structure. While perform in-Situ visualization of morphological changes of lithium metal anode during charging-discharging cycles and extract relevant data such as initiation time of nucleation, growth rate of dendrites, physical features of the dendrites. The data obtained would be used to contrast and test theoretical models developed by senior students in Archer research group. The results of this project will improve our understanding of dendritic nucleation and allow for the Archer Research Group to conduct future studies in mechanisms that prevent dendrites from even forming. Biography: Atsu Kludze is a sophomore at Cornell University pursuing a B.S. in Chemical Engineering with an expected graduation date of May 2021. In addition to being a Cornell engineering student, Atsu is a member of the Archer’s Research Group. He works as an undergraduate administrative assistant for Cornell’s Diversity Programs in Engineering and is a McNair Scholar. Acknowledgement Advisor: Dr. Archer Collaborators: Prayag Biswal (Chemical Engineering, CU) Special Thanks: Kent Jingxu Zheng, Sanjuna Stalin, Sonya Sokhey

**Atsu Kludze**
College of Engineering
Cornell University
McNair, ORSP & P3 Scholar 2021
Mentor: Professor Lynden Archer

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**Manufacturing Temperature and pH-responsive CS-g-PNV-CL Nanofiber Mats for Controlled Drug Delivery**

Disease manifests itself primarily in changes in the micro-environment, with temperature and pH being the most consequential factors. In effect, there is much interest in developing stimuli-responsive polymeric drug carriers which possess controlled drug release at different pH and temperatures. These technologies aim to preserve the bioactivity of the drug as well as localize the drug’s effect towards targeted cells and tissues. Poly(N-vinyl caprolactam) (PNVCL) is a biocompatible, temperature responsive polymer with a lower critical solution temperature (LCST) around physiological temperature (32°C). Chitosan (CS) is a biodegradable and biocompatible polymer that exhibits pH-sensitive and antimicrobial properties due to its terminal amine groups. Additionally, nanofiber mats hold a lot of promise towards creating controlled drug release carriers thanks to their large surface area and drug loading capacity. Thus, this project aims on chemically grafting chitosan onto PNVCL in order to produce dual responsive nanofiber mats impregnated with the selected antibiotic. Drug release rates will be examined at a broad range of pH and temperatures and with antibiotic with contrasting hydrophilicity. The relationship between the polymer’s molecular weight and rates of antibiotic release will also be examined.

**Alexis Martell Monterroza**
College of Agriculture and Life Sciences
Cornell University
McNair, Young Researchers Program, Chi Alpha Epsilon Honors Society & Chemistry Peer Mentors 2019
Mentor: Professor Margaret Frey
**Variation at the County Level in Mass Incarceration Rates**

Despite the decrease in the national prison population in the United States, recent data collected by the Vera Institute suggests that there has been rapid growth in jail admissions in many counties across the U.S. Since 1970, small and mid-sized counties have driven most of the mass incarceration growth. What factors explain this variation? This project gathers data from the U.S census on various county level factors such as race, median household value, educational attainment, and household makeup. Data collected from 1970, 1980, 1990, 2000, and 2012 in order to evaluate how change in county jailing relates to changing demographic, housing, and economic factors. Some of the research questions used to examine the data include: Why has jail incarceration rates been drastically increasing in smaller counties? Do counties nearby each other have similar policies and rates of incarceration? What are factors that must be added to our model to isolate key demographic and economic effects associated with the rise in mass incarceration? Through reading literature and developing various regression models to analyze the various relationships in the data, preliminary findings show that many counties’ usage of jails is increasing despite the national crime rate decreasing since 1991. This implies possible differences in racial discrimination and crime policies such as drugs and police presence.

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**Phenotypic Influence on the Functional Variation in Amphibian-Killing Fungus Batrachochytrium Dendrobatidis**

In the last 15 years, the amphibian-killing chytrid fungus known as Batrachochytrium dendrobatidis (Bd) captured the attention of conservationists as it dramatically decimated amphibian populations (James et al. 2015). In the laboratory, Bd cells and supernatants cause apoptosis and decreased lymphocyte proliferation of the host (Fites et al. 2013), both signatures of suppressed immunity. Though the differential virulence (Rosenblum et al. 2013 and Farrer et al. 2011) and immunosuppressive qualities of Bd are clear, there have not been many studies investigating the differential immunosuppressive qualities among the Bd lineages. Evaluating differential immunosuppression among Bd lineages in relation to their growth rate, zoospore size, and zoosporangium size will shed light on the mechanisms underlying the host-pathogen relationship between amphibian host species and the fungus that threatens 41% of its species.

A strong impact on the immune functions of the host could be one of the factors determining each lineages’ distribution globally as well as their impact on host amphibians. To compare the immunosuppressive abilities of Bd-Brazil, GPL, and Hybrid strains, Bd supernatant of 2x and 1x concentrations are grown in 96-well plates in the presence of Jurkat cells for 3 days and read spectrophotometrically to determine amount of Jurkat cells lost. To phenotype the Bd lineages, each of the strains from each lineage are grown over 15 days in 96-well plates and both spectrophotometrically read and photographed to determine the absorbance of each well as strains are growing and the largest average zoospore and zoosporangia size for each strain. Taken together, results can suggest whether there is a correlation between the immunosuppressive ability of a lineage and corresponding growth, zoospore size, and zoosporangia size phenotypes.
Methods of Hybrid Community Engagement for Data Collection on the Southside of San Antonio

Located in one of the fastest growing cities in the United States, the Urban Future Lab, led by Dr. Antonio Petrov, explores the rapidly changing dynamics of urban futures and how they relate to the geography of Southern Texas/Mexico. While the city is the seventh largest in the United States and has an estimated population increase of 1.4 million in the next 25 years, it is grappling with issues of inequality, social and economic mobility, and income segregation. As most San Antonio’s new developments are facing north, the region spanning south of US Highway 90 underscores that the geographic condition is a missing link between the southside and its various communities, the valley, and towns on both sides of the Mexican border. In collaboration with Southside First Economic Development Council, local tech startup Cityflag, and Local Initiatives Support Corporation (LISC), the Urban Future Lab has undertaken a community-driven pilot project on San Antonio’s southside to reinvigorate inactive assets in these communities. Upon researching the area, very little data on the assets, economy, and social networks of the southside existed, thus limiting how to go about this reinvigoration. This inspired an investigation of methods to collect data directly from the affected communities, with the goal of providing this data to the communities first so they can be informed in dialogues about their future and become active participants in developing community-driven strategies for economic revitalization and development. In this pursuit, the definition of collective knowledge was developed as was the larger strategy of hybrid community engagement. This effort aspires to generate data by the community for the community, with the aim to increase citizen agency and improve the frameworks in which it operates.

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Examining Racial Health Disparities in Nursing Home Quality of Life and Care

In the last 10 years, the number of minority older adults living in nursing homes has dramatically increased. Nursing homes (NH) account for 68 percent of the 72 billion dollars spent on long-term care in 2008, most of which was funded in part by Medicaid. This shift in demographics and large financial investment is an indicator of the critical demand to understand the specific needs of minority residents in nursing homes and long-term care facilities. Quality of life can be defined as the general level of social, physical, mental, emotional, and spiritual well-being experienced by individuals and societies. Quality of Care is focused on staff experiences and clinical measures. Previous research has found that there are racial disparities in quality of care for nursing home residents. The previous research, however, failed to isolate race/ethnicity differences from system-based issues in facilities with high-proportion minority residents. The long-term goal of the project is to develop an intervention focused on improving quality of life for nursing home residents across the United States. The study was designed using a multi-prong approach aimed at measuring the quality of life and care and the organizational structures and processes of care in high-proportion and low proportion minority resident facilities. The project will also examine the needs of minority older adults in long-term facilities as these are generally unknown.

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Soil Effects on Herbivore-Induced Plant Volatiles in the Push-Pull Agroecosystem and Variation of Parasitoid Attraction

Indirect defenses are an integral aspect of plant responses to herbivory. Herbivore-induced plant volatiles (HIPVs) have been shown to act as cues for natural enemies indicating the presence of prey. While there has been some work on the effects of intercrops on host plant volatiles, little is known about how companion crops may influence primary crop volatiles through soil effects. We set out to answer two questions: 1) Do plants change their HIPV emissions depending on the origin of the soil (push-pull vs. non-push-pull) they are grown in? 2) Do natural enemies respond more strongly to HIPVs associated with maize plants grown within the push-pull soil? We examined the interactions between Zea mays, two pests (Spodoptera frugiperda and Chilo partellus) and two natural enemies, a specialist egg-larval parasitoid (Chelonus sp.) and a generalist larval parasitoid (Cotesia sesamiae). In the lab, we exposed Z. mays to oviposition of S. frugiperda and neonates of C. partellus to determine whether maize grown in push-pull soil produces different HIPV profiles from maize from non-push-pull under pressure from different pests, and how those profiles influenced parasitoid attraction. We found that Chelonus sp. females were more attracted to maize induced by S. frugiperda oviposition only for maize grown in push-pull soil. Our results suggest that Chelonus sp. is able to pick up on detailed cues emitted by maize in push-pull fields, likely informing them about where to find their host, but that this effect may not be present in non-push-pull fields.

A Genome-Wide Association Study of Parkinson’s Disease in Rotenone-Treated Drosophila Melanogaster

Parkinson’s disease is a common neurodegenerative disorder caused by a loss of dopaminergic neurons when seen in humans. In Drosophila melanogaster, Parkinson’s disease can be induced using the pesticide rotenone. This pesticide targets the dopamine receptors in the neurons of the Drosophila and induces the phenotypic traits of the sporadic form of the disease. Sporadic Parkinson’s differs from the familial form in the sense that it does not have to be inherited; it can be induced by a culmination of genetic mutations that arise during gene editing or by the influence of external factors. In this study, a Rapid Iterative Negative Geotaxis (RING) assay was used to collect data on the climbing ability of over 130 distinct lines of Drosophila melanogaster obtained from the Drosophila Genetic Reference Panel (DGRP) which each have millions of single nucleotide polymorphisms (SNP). These differences in genetic sequence make it possible to analyze the data collected using genome-wide association techniques, which identify the genetic variants that modulate the severity of the impact of rotenone. The early stages of Parkinson’s are not yet well understood, and this study nominates a list of genes to investigate further in hopes of finding the genes responsible for enhancing and suppressing it. If these nominated genes are found to be significant in Drosophila, their human homologs will then be studied.
Potential Cross Linkers for Vanillin Derived Sequenced Defined Polymers

Synthesizing sequence defined polymers in an industrial or laboratory setting has always proven to be difficult process to overcome even though it has been readily done in biological systems for thousands of years. In attempting to understand these processes, sequence defined polymers are constructed using the compound Vinyl as a backbone for the polymer. Different potential cross-linkers were investigated including a hydride terminated poly siloxane compound, along with a similar compound with modified end groups. These cross-linkers were reacted with polymers with similar number of binding sites as the sequenced defined polymer to attest the conditions to optimize the yield of the reaction.

“I was able to develop many fundamental research skills that I will definitely use later in life. This summer internship has only reinforced my goals and intentions for doctoral study.”

~McNair Scholar

Changes in Bone Geometry Caused by Disruption of the Gut Microbiome Depend on Stage of Skeletal Growth

Alterations to the gut microbiome throughout an animal’s life have been shown to change bone mechanical properties and tissue material properties of bone [1]. However, it is not known if alterations to the gut microbiome affects all bone in the body or only affects bone matrix as it forms. To test the idea that the microbiome influences bone at the time of matrix formation, we modified the gut microbiome of mice at different ages during growth. Male C57BI/6 mice were divided into three groups: untreated (n=10), disrupted microbiome from 4-10 weeks (n=9), and disrupted microbiome from 10-16 weeks (n=10). Disruption of the gut microbiome was achieved using oral antibiotics (1g/L ampicillin and 0.5g/L neomycin in drinking water). The mice were euthanized at skeletal maturity (16 weeks of age). Micro-computed tomography (25µm voxel size) was used to analyze the femoral cross-sectional geometry. The cross sectional area of the group treated from 10-16 weeks was 10.8% smaller compared to the untreated group (Fig.1C). Cross sectional area was less in the 10-16 week group than the other two (p<0.05). The moment of inertia was 21.9% smaller (Fig.1A) and the section moduli was 20.3% smaller (Fig.1B) in the 10-16 week group compared to the untreated group. Section moduli and moment of inertia for the 4-10 week group had intermediary values compared to the other two groups, but was not noticeably different. Disruption of the gut microbiome affects the geometric properties of long bones. Since most bone is formed from 0-10 weeks of age [2], our finding that the group treated from 10-16 week had the largest changes in bone geometry suggests that disruption of the gut microbiome influences the geometry of bone tissue at the time of disruption. Hence, manipulations of the gut microbiome may be useful to improve bone structure/mass. Further work will be conducted to determine the associated mechanical.

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Emotional Well-Being and Somatization Among Urban and Rural Latina Breast Cancer Survivors

Latina breast cancer survivors report worse emotional well-being (EWB) than their white counterparts, possibly due to limited resources, and it is currently unknown whether rural and urban Latina breast cancer survivors differ on EWB and somatic symptoms. This secondary cross-sectional analysis was conducted at the National Institutes of Health on baseline data from two randomized studies testing a cognitive-behavioral stress management program in urban and rural regions of California. Bivariate tests were used to analyze the urban/rural differences in sociodemographics, financial hardship and perceived neighborhood cohesion followed by multivariate analysis on EWB and somatic symptoms on urban or rural location, marital status, financial hardship, and neighborhood cohesion controlling for sociodemographics. Rural Latina breast cancer survivors tended to be older, were less likely to report any financial hardship, were more likely to be married, were less likely to report poor or fair self-rated health, reported more neighborhood cohesion compared to their urban counterparts, better emotional well-being and fewer somatic symptoms. Controlling for covariates, urban residence and greater financial hardship were associated with poorer EWB and more somatic symptoms, yet greater neighborhood cohesion was associated with better EWB. These findings suggest urban Latina breast cancer survivors may be at particularly elevated risk of psychosocial distress and warrant more frequent distress screening. By addressing such factors, we could potentially reduce psychosocial health disparities among Latina breast cancer survivors when we design mental health interventions for them.

The Effect of Drought on Leaf Litter Decomposition in the Northeastern United States

In 2016, Tompkins County, in central New York State, experienced the strongest drought since the U.S Drought Monitor began in 2000. Consequently, deciduous trees in the region went through their 2016 growing season with minimal soil water levels. During the following year in 2017, precipitation returned to normal and these trees experienced a growing season with adequate soil water levels. The purpose of this research is to examine the effect of drought on the chemistry and subsequent decomposition of leaf litter. Leaf samples from five broadleaf, deciduous tree species (Acer saccharum, Ostrya virginiana, Quercus rubra, Quercus alba, and Tilia americana) were collected from the same individuals in 2016 and 2017 in a forest plot in Ithaca, NY. Samples of both drought and non-drought leaf litter for each species were placed in leaf litter bags in the same field plot in which they were collected for a decomposition study. Leaf litter decomposition was examined between December 2017 and October 2018. The initial and final mass were recorded to determine mass loss over time and the leaf litter chemistry was analyzed to examine relationships with mass loss. Leaf litter decomposition is an important part of the global carbon budget, and due to the relationship between climate and decomposition, climate change may have a significant impact on decomposition. Since droughts are expected to increase in both frequency and severity due to climate change, it is important to quantify the impact of drought on this pathway and forest systems as a whole. Key words: Drought, Forest Ecology, Climate Change, Leaf Litter Decomposition.
"Whether or not you reach your goals in life depends entirely on how well you prepare for them and how badly you want them. You’re eagles! Stretch your wings and fly to the sky.”

~ Ronald McNair

“I was a McNair Scholar at Grand Valley State University, my undergraduate alma mater. Through the guidance of that program, I pursued and earned a doctorate at Emory University. I am living proof that McNair is effective in helping underrepresented individuals achieve the goal of Ph.D. attainment. As the McNair Program Coordinator & Advisor at Cornell, it is amazing to give back to a program that has given me so much. I am thrilled to work with such incredible students along their own journeys toward the Ph.D.”

~ Dr. Rachel Dudley
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