CUNY | Research Scholars Program

List of CSI CRSP students and their abstracts presented at the 2018 CRSP Symposium

Brain Insulin Receptor Expression, and the Control of Neuronal Excitability

MD Zahirul Islam and Mohammad Mansour
Mentor: Professor Abdeslem El Idrissi

The endocrine pancreas in mice undergoes significant remodeling in neonatal life. In the fragile X Knock Out mouse brain there is increased functional activity measured by glucose metabolism which is consistent with hyper-activity observed in fragile X syndrome. Therefore, we sought to evaluate the role of the elevated glucose metabolism observed in the fragile X brain. KO mice had a significant reduction in the number of islets of Langerhans with no histopathology in the endocrine or exocrine part of the pancreas. Mice were administered a glucose tolerance test (via injection of 7.5 % glucose solution after 12h food deprivation). KO's showed significant increases in plasma glucose levels (30 min post injection) compared to control's by 2 hours post glucose injection, control's became hypoglycemic compared to baseline; whereas KO's showed a protracted response and remained hyperglycemic. Concomitant with the decreased islets size and glucose intolerance observed in KO's there was a decrease in insulin, glucagon and somatostatin immunoreactivity in β, α and δ cells in the pancreatic islets. Lastly, KO's were susceptible to the diabetogenic effects of alloxan. Taurine supplementation in drinking water resulted in a significant increase in the number and size of the islets, increased in glucagon and somatostatin immunoreactivity levels in the pancreas and provided resistance against alloxan-induced hyperglycemia. Studies showed that islets from taurine supplemented mice double in the number of PCNA immunopositive cells. This increased proliferation was accompanied by a reduction in the incidence of apoptosis in islet cells, and also a significant increase in the number of immunopositive IGF-II islet cells. Peak islet cell apoptosis is maximal in mice pancreas 14 days after birth and is temporally associated with a fall in the islet cell IGF-II expression. IGF-II was shown to function as an islet survival factor in vitro. The induction of islet cell apoptosis in vivo may involve increased iNOS expression within β cells. Interestingly, taurine inhibits iNOS. We hypothesize that taurine supplementation, may reduce cytokine-induced apoptosis in pancreatic β cells. This in turn increases the size of pancreatic islets and confers tolerance to glucose and resistance to alloxan-induced hyperglycemia. The endocrine pancreas undergoes important modifications thus, resulting in altered islets development, pancreatic cell mass, glucose handling and susceptibility to hyperglycemia. Here we proposed a model that may explain the cellular mechanisms that leads to altered pancreatic function in the fragile X mouse.

Design and Control of a Low-Cost 2D Plotter

Mobin Uddin Chowdhury
Mentor: Professor Aleksandar Haber

The aim of this project is to develop a low-cost 2D plotter capable of accurate reproduction of trajectories defined by the user. The developed plotter has a Cartesian configuration and consists of two stepper motors controlling the X and Y axes using the system of pulleys and belts. The pen of the plotter is attached to one of the axes. The feedback information about the pen position is provided by two encoders. The control system consists of an Arduino microcontroller and two stepper motor drivers. Using the encoder feedback information, the PID controller generates control voltages for the stepper motor. The developed control system is able to attenuate system vibrations and to reject external disturbances. In this way, the system positioning accuracy and trajectory tracking performance is significantly improved. Our preliminary results show that such a low-cost system is able to achieve a 100 micrometer positioning accuracy. In our future work, the developed system will be used to test advanced machine learning algorithms for improving its performance. Due to the fact that the working principle and configuration of the developed 2D plotter is similar to a large variety of mechanical systems, such as for example, 3D printers, CNC machines and laser cutters, the results and insights obtained in this project can be useful for improving the performance and accuracy of a large-number of mechatronics systems.

Predictors of geographic range size of Western North American bird species

Nicole Guzman
Mentor: Professor Lisa Manne
Poster Presentation Award Winner

Range size is the spread of species in a geographical area, it is important to study because these are the areas in which species breed, migrate and feed in. If the range size is affected in any way this also affects the species. This shows that range sizes have an affect on how species live and there are relationships that species share with the areas that they live in. We need to study range size to better understand the relationships to have healthier environments in which our species can thrive in. Commonly, larger-bodied animals need larger ranges in which to persist. Species that are able to utilize a larger variety of resources (such as food resources, or habitat) have lowered extinction risk, and might also have larger range sizes. Species that are more vagile might be more vulnerable to extinction (due to the need to move seasonally between resource-rich environments), or might have lowered extinction risk, due to this ability to move between habitats. Two students and myself worked with Dr. Manne to study the life cycle, habitat, migratory guild and body size of Western American, Spanning and European species. We test the relationship between these traits and the birds' range sizes, while accounting for inter-relatedness between predictors (e.g. habitat and migratory guild). To do this, we will conduct path analysis, which finds a path diagram to relate the traits of these birds to range sizes. Another analysis of this type, for European birds, found that rapid reproduction rates, movement from birth site to breeding sites and habitats have a positive effect on range size. While as diet had an negative effect. We compare our results for Western North American

birds to the results for the European birds. As well gather and combine the findings of the Spanning and European species to analyze which traits affect range size.

Identifying Synergizers with TGFb Inhibition in Glioblastoma Using a Cell-Based Model

Arouje Shaikh, Briana Soto, Xiangliu Yang, Fatima Rizwan
Mentor: Professor Nancy Liu-Sullivan

Glioblastoma Multiforme (GBM) is the most aggressive type of glioma of the central nervous system (CNS) that can be found in the brain or the spinal cord. GBM represents 14.9% of all primary brain tumors, and 55.4% of all gliomas. Adults with more aggressive glioblastoma have a median survival of about 14.6 months and two-year survival of 30%. GBM consists of a mixture of cell types and many cytokines that promote its growth and metastasis. A cytokine called Transforming Growth Factor Beta (TGFb) has been found to play a crucial role in GBM growth and metastasis. LY2157299 is a small molecule inhibitor designed to block TGFb signaling by inhibiting TGFb receptor I expressed on the cell surface. Identifying synergistic compounds, will enable us to modulate cytokine signaling and examine the reduction rate of tumor development. Reported studies have revealed that the LY inhibitory effect in tumor cell growth is less than 50%, suggesting the involvement of the additional signaling pathways. We are working toward identifying potential drug combination such as IDH1, SMAD4, and p27; that would modulate cytokine signaling and to enable stunted tumor proliferation. Findings of this study has the potential of identifying a treatment strategy for GBM.

Remotely Controlled Mechatronics Systems

Abel Pepin and Ralph Joseph
Mentor: Professor Aleksandar Haber

In this project, we develop and investigate the performance of a low-cost system for remotely controlling mechatronics components. Such a system can be used for remote control of unmanned aerial vehicles and robots. The system consists of two Arduino microcontrollers (master and slave) and two wireless transceiver/receiver modules. In addition, the slave microcontroller is used to control a stepper motor that moves a cart sliding on linear rails. The purpose of the system is to control the cart position using remotely located master microcontroller. The master microcontroller wirelessly sends control information to the slave microcontroller. The slave microcontroller receives the control information and translates it into control voltages for the stepper motor. Once the control actions are executed and the cart moves to the desired position, the slave microcontroller sends the confirmation message to the master controller. Our preliminary results show that such a system can reliably operate even when the distance between the master and slave microcontrollers is 70 meters. In our future work, we will use this system to develop feedback control systems for autonomous driving vehicles.

Comparing Media Literacy of Adolescents and College Students

Cody Barshaba
Mentor: Professor Patricia Brooks

In today's world, where concerns about fake news, misinformation, psychographic research, and the power of algorithms to disrupt democracy proliferate, students need support in navigating the digital environment. In a recent study, Powers and colleagues (2018) validated a general media literacy scale (Bier et al., 2011) and explored relationships between media literacy and social media use, media multitasking, and academic achievement in middle-school students (N = 78; mean age 13 years, range 11-15 years). Adolescents' media literacy scores correlated positively with self-reported grades and negatively with self-reported social media use and media multitasking. These results suggested that experience with social media use, in particular, may not promote media literacy skills. Additionally, youth may need targeted media literacy skill instruction to reduce their vulnerability to misinformation via digital media and enhance their critical evaluation of content found through these sources. Media literacy is also a critical set of skills for college students. Recent research shows that college students lack skills in fact-checking and are unable to judge the credibility of online information (Wineburg et al., 2016). The present study aims to validate the media literacy scale used in Powers et al. (2018) with college students and incorporate new measures that specifically targeting digital information literacy, as opposed to other media such as advertisements.

Assesing Emotion Recognition in Children with ASD

Nada Mohamed
Mentor: Professor Betram Ploog

The proposed experiment will use a behavior-analytical approach to evaluate emotion recognition in children with autism using an iPad as a mobile-game device. Many studies have been conducted on emotion recognition in autism but inconsistent findings have been reported. Reasons for inconsistencies could be differences in the type of stimuli, the intensity of the stimuli used, the type of task used to assess emotion recognition, varying sample sizes, different functioning level of the participants as well as different chronological ages, or the types of emotions assessed. The purpose of the present study is to asses any emotion recognition deficits in individuals with autism when compared to typically developing individuals, to identify reasons for previous inconsistencies, and to provide remediation if such a deficit will be found, which in turn will allow us to test for converging evidence of behavior analytic and eye-tracking approaches. The behavior-analytic approach as at least one advantage over eye-tracking approaches because it allows us to assess whether the participant actually paid attention to the stimulus or merely looked at it. Specifically, a matching-to-sample paradigm will be used with a variety of stimulus types such as photos of human expressions, cartoon drawings, emoji faces, and geometric shapes.

The Relationship Between the Presidency and Economic Beliefs

Kailey Volpetti
Mentor: Professor Florette Cohen

This study examined participants' approval rating of President Donald Trump and how they felt about their economic situation this year. Participants, using a 5-point Likert scale, rated how much they approved or disapproved of President Trump, and how much better or worse they believed their economic situation would be this year. In 76 participants (42 female, 33 male), we found a significant positive relationship (r=.48) between support for the President and people's economic situation.

Those who had a stronger approval rating believed that their economic situation would be better this year. Those that did not approve of President Trump believed their economic situation would become worse. As a result of this study, it appears approval ratings of President Donald Trump and feelings of economic situation have a significant positive relationship.

Alzheimer's and Diabetes: The effect of Abnormal Tau on Proteins Related to the Glucose Metabolism.

Marina Ghobrial
Mentor: Professor Alejandra Alonso

Alzheimer's disease (AD) is a progressive condition that destroys the neuronal connections in the brain, eventually causing the neurons to die. The damage in the brain ultimately causes problems with memory, intelligence, judgment, language and behavior. It has been found that Tau, a microtubule associated protein (MAP) predominately localized in neuronal axons, can become hyperphosphorylated and lead to the neurodegeneration that we see in AD.
Studies have shown that diabetic individuals are 50-100% more at risk for AD and vise versa. Type II diabetes is a metabolic disorder with a pathophysiology of peripheral insulin resistance, excessive hepatic glucose production by the liver, and impaired beta-cell secretory function. To understand the connection between Type II diabetes and AD, we use a mouse model in order to determine how the presence of human Tau affects proteins related to the glucose metabolism using an immunohistochemical approach. I will be presenting preliminary results on the correlation of Insulin receptors and Tau as well as Glucose transport and Tau.

Synaptic deficit in Alzheimer disease, is abnormal tau the culprit?

Izabella Beniaminova
Mentor: Professor Alejandra Alonso

Alzheimer disease (AD) is a dementia characterized by the presence of hyperphosphorylated tau. Tau is a microtubule associated protein, which promotes tubulin assembly into microtubules and therefore facilitates normal neuronal transmission. In pathological conditions, hyperphosphorylated tau is present, and a decrease in the neural activity can be seen. In AD, the microtubules are disrupted and an earlier damage to the synapsis has been reported. In our lab, we have developed an inducible mouse model of neurodegeneration that expresses Pathological Human tau (PH-Tau), with modifications at Ser199, Ser262, Thr212, and Thr231, along with frontotemporal mutation R406W. PH-Tau can be expressed at two levels, 4% of the endogenous tau (PH-Tau low) and upon induction high levels, 14% of the endogenous tau (PH-Tau high). Expression of PH-Tau at both levels induced cognitive decline, in PH-Tau low because of synaptic abnormalities observed by electron microscopy and in PH-Tau high because of neuronal loss.
In an effort to understand the synaptic abnormalities, we studied the levels of synaptic protein, the postsynaptic density protein 95 (PSD95) along with calbindin. Animals expressing PH-Tau and controls were perfused and coronal slices of the brain were stained with monoclonal antibodies to human tau to trace the N-terminus of tau protein and with antibodies for PSD95 and calbidin. The hippocampal CA3 area, the cerebellum and the cerebral cortex were the main areas of interest. The biochemical characterization showed high levels of the PSD-95 present in the control group and lower levels of expression upon PH-Tau increment. This observation was corroborated by

immunohistochemical data. Calbidin levels were also altered by the presence of PH-Tau. These results taken together suggest that low levels of PH-Tau can modulate the levels of synaptic protein, altering synaptic stability and therefore neuronal function.

Creating s baseline of Staten Island Beach Morphology

Jennifer Avila-Sanchez
Mentor: Professor Jane Alexander

Staten Island is a submergent coastline like the other 4 boroughs in New York City, meaning that relative sea level is slowly rising over time. There are constant changes in the shore line due longshore drift and more rapid changes during storms, that can affect residents near the coastline. Studying these changes is important to help withstand future storms and reduce devastation, as last seen caused by Hurricane Sandy. In this project, the main objective is to see how the coastline has changed since Hurricane Sandy by analyzing the sediment buildup and to create a detailed baseline of beach morphology for interpreting future changes. Previous work has been done using a geospatial approach to determine the sediment movement, but in this experiment, beach profiles are to be created for various areas along the eastern and southern shore of Staten Island at low tide. Additionally, 3 sediment samples are collected for each beach profile to be later sieved by size and to determine if there is a relationship between grain size and beach location.

Low-cost System for Surveillance, People Recognition and Threat Detection

Anvarjon Nurakhunov
Mentor: Professor Aleksandar Haber

The problems of developing reliable and low-cost systems for surveillance, people recognition and threat detection are one of the most challenging engineering and scientific problems. The solutions to these problems will lead to improved safety of our schools and neighborhoods, as well as to improved performance of our public transportation systems. Motivated by these problems, this project aims at developing a low-cost surveillance and people recognition system using a Raspberry Pi microcontroller, web camera and Artificial Intelligence (AI) algorithms. On the basis of a video recorded using the web camera, the AI algorithm will detect the number of person present in a room. In addition, the AI algorithm will recognize a person and estimate its threat level. For example, the system should be able to recognize if the person is carrying a weapon. This information will be sent through a wireless connection and the Internet to a cell phone application. The total estimated cost of such a system is below $100, which is a significantly lower cost than the cost of a commercial system with similar capabilities.

Low-cost Vertical Positioning System

Francesco Pecora and Marjan Perbibaj
Mentor: Professor Aleksandar Haber

We have developed a low cost system for precise vertical positioning of small-sized objects. The system consists of a cart that slides on linear rails. The movement of the cart in a vertical plane is achieved by a stepper motor and a belt and pulley system. The system support is built using aluminum

extrusions. The system is controlled using an Arduino microcontroller and a micro-step motor driver. The feedback information about the position of the cart is obtained using a rotary encoder that is attached to one of the pulleys. Mechanical limit switches restrict the motion range of the cart. Furthermore, once the limit switch is activated the cart changes the movement direction.

Our experimental results show that such a low-cost system is able to accurately position a 4-pound weight. The maximal weight that the system can lift is approximately 6 pounds. In our future work, we will increase the lifting capacity by introducing a gear reducer and a threaded rod.