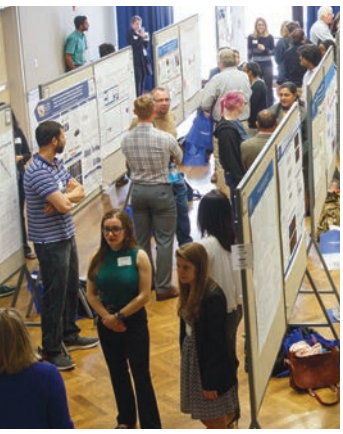

GW RESEARCH DAYS

TUESDAY, APRIL 10, 2018

THE GEORGE WASHINGTON UNIVERSITY

WASHINGTON, DC

GW RESEARCH DAYS 2018

ANNUAL RESEARCH DAY

TUESDAY, APRIL 10, 2018

MARVIN CENTER

800 21ST STREET, NW, 3RD FLOOR

8:30–10:00 a.m.	**Registration and Poster Setup** *(Grand and Continental Ballrooms)*
10:00 a.m.–1:00 p.m.	**Poster Presentations and Judging** *(Grand and Continental Ballrooms)*
1:00–2:00 p.m.	**Poster Removal** *(Grand and Continental Ballrooms)*

RESEARCH DAYS WEBSITE

ONLINE - *https://researchdays.gwu.edu*

5:00 p.m.	**Poster Winners Announced Online**

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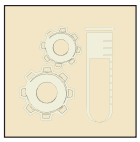


SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Acoustic Vaporization Threshold of Lipid-Coated Perfluoropentane Droplets for Tumor Imaging and Drug Delivery Applications

Ultrasound has been embraced as a non-invasive, well-understood and relatively inexpensive tool for diagnostic and therapeutic purposes compared to other imaging modalities such as computed tomography, positron emission tomography and magnetic resonance imaging. However, this modality suffers from low sensitivity. To overcome this limitation, ultrasound contrast agents have been introduced which are gas-filled colloidal particles with a size range of 1-7 micrometers. Ultrasound has been embraced as a non-invasive, well-understood and relatively inexpensive tool for diagnostic and therapeutic purposes compared to other imaging modalities such as computed tomography, positron emission tomography and magnetic resonance imaging. However, this modality suffers from low sensitivity. To overcome this limitation, ultrasound contrast agents have been introduced which are gas-filled colloidal particles with a size range of 1-7 micrometers. In this work we are making lipid coated nanodroplets as novel ultrasound contrast agents. These droplets undergo a phase transition to the highly echogenic gaseous state and are convertible to micron-sized bubbles upon the input of sufficient acoustic activation energy which is termed as acoustic droplet vaporization (ADV). We investigate the ADV thresholds and its dependence on acoustic parameters and host fluid properties. In addition, we also compare the scattered response from droplets with that of conventional microbubbles at the corresponding excitation pressure and frequency.

PRIMARY PRESENTER

Mitra Aliabouzar

STATUS

Student – Graduate

AUTHORS

Mitra Aliabouzar

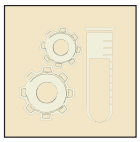
Krishna Kumar

Kausik Sarkar

RESEARCH MENTOR/ DEPARTMENT CHAIR

Kausik Sarkar

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Ultrasound Modulation of the Electromechanical Function of Human Stem-Cell-Derived Cardiomyocytes

In the United States alone more than 300,000 people die suddenly every year with the cause of death being cardiac arrhythmia. The two most popular methods for cardiac function modification are electrical and chemical. It is our hypothesis that through the use of low intensity non-ablative ultrasound, we can modify cardiomyocite (CM) action in the form of activation or suppression of ion transport. Further for dyssynchronous beating we can reactivate synchrony and achieve pacing of CMs.

To the best of our knowledge, this is the first study done on the therapeutic effects of low intensity ultrasound on human pluripotent stem-cell-derived ventricular CMs. CMs were plated in confluent monolayers. We used an in-house developed platform for all-optical cardiac electrophysiology, termed OptoDyCE, to optogenetically pace the CMs while recording optically intracellular calcium (Rhod-4) and membrane voltage (di-4-ANBDQBS) in a spectrally-optimized manner. Ultrasound probes were combined with the in-house developed OptoDyCE platform. The probes were operated at 600 and 800 kHz and 1 MHz at intensities of 0.5 and 1 W/cm^2. This integrated system allowed quantification of cell behavior prior, during and after the application of the ultrasound.

We explored a range of ultrasound parameters while simultaneously monitoring the electromechanical response of the CMs. Little effect was seen at 1 MHz and 800 kHz. CM behavior was most affected by 600 kHz ultrasound at 0.5 W/cm^2. Just one second of sonication with these parameters instantaneously increased the natural beat frequency of the CMs from around 0.16 Hz to 0.28 Hz. A distinctly different mechanism of pacing was observed, with partial calcium release preceding and likely triggering the action potentials. The ultrasound effect appears to be caused by fast onset of cellular processes rather than slower thermally mediated events. Ongoing work will focus on refining ultrasound stimulation parameters, through spatial temporal analysis of the data, and determining the mechanism by which ultrasound modulates intracellular calcium and membrane voltage. This work can impact the fields of stem cell biology for cardiac repair and personalized medicine. It can also inspire a new generation of ultrasound in vivo rhythm control devices.

PRIMARY PRESENTER

Andrew William Chen

STATUS

Student – Graduate

AUTHORS

Andrew William Chen

Aleksandra Klimas

Ivan Suarez Castellanos

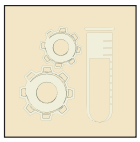
Emilia Entcheva

Vesna Zderic

RESEARCH MENTOR/ DEPARTMENT CHAIR

Vesna Zderic

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Breast Cancer Detection Using Transfer Learning in Convolutional Neural Networks

Computer-aided diagnosis (CAD) in mammography can improve treatment outcomes for breast cancer and provide greater survival times for patients. For breast cancer detection, the Convolutional Neural Network (CNN) can extract features from mammographic images automatically and then do classification.

To train the CNN from scratch, however, requires a large number of labeled images. Such a requirement often is infeasible for some kinds of medical image data such as mammographic tumor images. A promising solution is to extract features by reusing a pre-trained CNN model that has been trained by very large image datasets from other fields; alternatively, we could re-train (fine-tune) such a model using a limited number of labeled medical images. This approach is also called *transfer learning*.

In this study, we applied the pre-trained VGG-16 model to extract features from input mammographic images and used those features to train a Neural Network (NN)-classifier. We firstly downloaded mammographic images from the DDSM database and cropped the Regions of Interest (ROIs) of given abnormal areas as ground-truth information. We used the ROIs instead of the entire images to train neural networks. The structure of CNN in transfer learning was the combination of the 13 convolutional layers in pre-trained VGG-16 model with a simple full-connected (FC) layer. The weights in the FC layer were randomly initialized and updated by training; other weights were not changed.

We used 1300 abnormal ROIs and 1300 normal ROIs. All ROIs were randomly selected and shuffled in class sets. After 100 epochs, the average of 10-fold cross validation accuracy converged at about 0.905 for abnormal vs. normal classifications on mammograms, with no obvious overfitting. Our best model could reach 0.950 accuracy for the abnormal vs. normal case, and the area under the receiver operating characteristic curve was 0.96. This study shows that applying transfer learning in CNN can detect breast cancer from a mammogram, and that training a NN-classifier by feature extraction is a feasible method in transfer learning. Our research is important because it provides a novel technique to improve mammographic detection. Compared with other studies in this field, this study used a different pre-trained model, simpler classification architecture, and classifier, and used more images (2600), and performed at least as well.

PRIMARY PRESENTER

Shuyue Guan

STATUS

Student – Graduate

AUTHORS

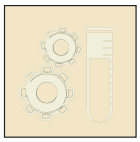
Shuyue Guan

Murray Loew

RESEARCH MENTOR/ DEPARTMENT CHAIR

Murray Loew

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Development and Characterization of a Tumor Tissue Mimicking Phantom System for Evaluation of High Intensity Focused Ultrasound Therapy

High intensity focused ultrasound (HIFU) has been previously used as a minimally-invasive surgical technique for the thermal ablation of malignant tumors with little to no damage to the surrounding tissue. Development of a physiological phantom is significant for testing the safety and effectiveness of HIFU devices by the U.S. Food and Drug Administration. The novel aspect of this study is the integration of multiple tissue-mimicking components to form a comprehensive phantom modeling a human thigh with a tumor.

A phantom with healthy tissue mimicking material, an embedded vessel mimicking the deep femoral vein, a tumor, and a human femur bone mimic was developed for the acoustic and thermal evaluation of HIFU. The vessel created mimics the 6 mm diameter and 12 cm/s flow rate of the deep femoral vein. Blood mimicking fluid was made following the protocol published by Liu et al. Soft tissue sarcoma mimics were created using a hydrogel tissue mimic and chondrosarcoma mimics were cast using polyurethane casting resin and aluminum oxide powder. The tumor formulation with the closest attenuation and thermal properties to published values were used. For the femur mimic, a hollow cylindrical cortical bone mimic was purchased from True Phantom Solutions (Windsor, ON, Canada).

The bone mimic has a speed of sound between 3000-4000 m/s at 1 MHz and the acoustic attenuation is ~12 dB/cm at 3 MHz which correspond to literature values published for human cortical bone. These values were confirmed using a transmission-mode set-up with a percent error less than 15%. Thermal conductivity and specific heat for the bone mimicking material was determined to be within 1% and 13% of human cortical bone values respectively. Hydrogel tumor mimics have thermal properties within 10% of soft tissue sarcomas.

Preliminary testing indicates creating a phantom that mimics a human thigh containing a tumor is feasible. Bone mimic acoustic and thermal properties matched physiological values of human cortical bone. A wall-less vessel is an appropriate heat sink to remove heat from the system during HIFU ablation. Therefore, the created phantom is appropriate for developing standardized HIFU dosimetry techniques and determining the safety and efficacy of HIFU ablation devices. Continuing work includes repeatable temperature elevations in the phantom that can be measured with embedded thermocouples under various HIFU exposures.

PRIMARY PRESENTER

Devon Guerrelli

STATUS

Student – Undergraduate

CO-PRESENTER

Victoria Doheny

AUTHORS

Devon Guerrelli

Victoria Doheny

Aidan Canning

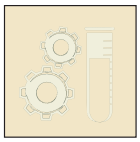
Nikkita Khattar

Vesna Zderic

RESEARCH MENTOR/ DEPARTMENT CHAIR

Vesna Zderic

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

A Novel microRNA, miR-p14-1, Frequently Down-Regulated in Melanoma, is Associated With Loss of p14ARF Expression

Melanoma is the most aggressive and lethal skin cancer due to its propensity to metastasize if it is not detected early. CDKN2A has been recognized to be the first high-risk susceptibility gene in melanoma. The CDKN2A locus encodes two tumor suppressors, p16INK4a and p14ARF, with different promoters. p14ARF encodes a small basic nucleolar protein restraining abnormal cell growth and maintaining genomic stability via p53-dependent or independent pathways. Inactivation of p14ARF occurs independently of p16INK4a inactivation in melanoma with a low frequency of p14ARF mutations, suggesting that p14ARF epigenetic silencing may represent an important event in melanoma progression. However, the mechanism of p14ARF regulation in melanoma remains unclear. MicroRNAs (miRNAs) have been identified as a class of important regulators of gene expression. Most miRNAs are called intronic microRNAs, which are co-expressed or acted similarly to their host genes. We previously characterized a deletion of 67 AT-rich repeat (ATRR) nucleotide at the first intron of p14ARF in a patient with melanoma that resulted in the inactivation of p14ARF and DNA repair deficiency, indicating its potential function on p14ARF expression. We hypothesize that the deleted ATRR sequence encodes novel miRNAs, which may function as tumor suppressors by promoting p14ARF expression. Bioinformatics analysis revealed the ATRR sequence is conserved across species and highly homologous with three bona fide miRNAs. Furthermore, its secondary structure analysis showed that it meets the criteria for selecting pre-miRNAs. We then predicted two putative miRNAs according to the ATRR sequence, named miR-p14-1 and miR-p14-2. The p14ARF gene sequence scanning revealed several potential miR-p14-1 binding sites in the p14ARF promoter region. Initial quantitative reverse transcriptase PCR (qRT-PCR) analysis indicated that only miR-p14-1 is an expressed transcript. Therefore, we focused on the correlation between miR-p14-1 expression and p14ARF expression in melanoma cell lines and microdissected Formalin-Fixed, Paraffin-Embedded (FFPE) tissues. We found that miR-p14-1 and p14ARF expression are positively correlated in the 17 melanoma cell lines, using the nonparametric Spearman's rank correlation, with a coefficient of 0.779 and a *p*-value of 0.0001. In addition, we showed that miR-p14-1 expression was significantly downregulated in 10 of 15 (67%) melanoma tissues compared to normal adjacent tissues. These data suggest that miR-p14-1 functions as a tumor suppressor by promoting p14ARF expression in melanoma. This finding not only helps elucidate the mechanisms of frequent inactivation of p14ARF in melanoma, but also serves as a novel target for melanoma management.

PRIMARY PRESENTER

Millie Ho

STATUS

Student – Undergraduate

AUTHORS

Millie Ho

Zhongwu Li

Hong Qi

Qing Pan

Patricia Latham

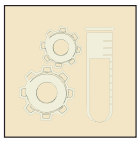
Sidney W. Fu

Xiaohui Tan

RESEARCH MENTOR/ DEPARTMENT CHAIR

Xiaohui Tan

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Intra- and Inter-Observer Variability and Reliability of the Femoral Artery Pseudoaneurysms Neck Measurements from B-Mode Ultrasound Images

Pseudoaneurysms as complications are a major source of morbidity after cardiac catheterization. Femoral artery pseudoaneurysm is a pulsatile hematoma that is mostly formed after penetrating trauma, surgical procedures, and femur fractures. The incidence of femoral artery pseudoaneurysms (FAPs) after diagnostic catheterization ranges from 0.05% to 2%. The incidence increases to 6% after more complex procedures. The untreated pseudoaneurysms lead to infection, cause emboli, and can rupture. Also uncommonly they may lead to thrombosis, limb loss, and death. Therefore, the early detection of the FAPs is significant for the early treatment. Even though computed tomography (CT) can provide a very high-resolution image of the FAPs' structure, patients undergo two rounds of radiations pre- and post contrast with energy of 120 KV, which is quite high. Therefore, ultrasound remains the cornerstone of diagnostic imaging for patients with groin complications after catheterization. However, ultrasound imaging of the FAPs mainly provides details about the blood flow not the structure. Therefore, the need for measuring tool to provide the physicians with the correct border of the FAPs has increased. It is important to report the FAPs' neck measurement since the treatment options depend on the size of the FAPs' neck. Necks measured 2 cm or higher require surgery. Necks less than 2 cm require prolonged compression or thrombin injection. The goal of this study is to enhance the appearance of the FAPs' borders and to report the intra- and inter-observer variability and reliability of the FAPs' neck measurements from the ultrasound images. Twenty ultrasound images from 2010–2017 with FAPs were acquired from George Washington Hospital (GWH) after obtaining the IRB approval. Two observers will be involved in this study to preprocess, segment, and measure the FAPs' neck. Each measurement will be done twice within two weeks time interval between the two trials to avoid recall bias. Statistical analysis will be performed by SPSS and Microsoft Excel. The intra- and inter-observer reliability will be evaluated by calculating the standard error of measurements (SEM) and the interclass correlation coefficients (ICC (2, 1)) using a two-way random model with absolute agreement. The ICC value between 0.80-1.00 is considered as good reliability, 0.60-0.79 is considered as moderate reliability, and <0.60 is considered as poor reliability. The intra- and inter-observer variability will be evaluated by calculating the mean absolute difference (MAD) and the standard deviation of the absolute difference (SD).

PRIMARY PRESENTER

Reham Kaifi

STATUS

Student – Graduate

CO-PRESENTER

Lauren Price

AUTHORS

Reham Kaifi

Lauren Price

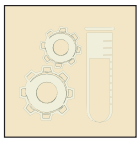
Babak Sarani

Vesna Zderic

RESEARCH MENTOR/ DEPARTMENT CHAIR

Vesna Zderic

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Reproducibility of Quantitative Image Texture Features in Identifying Tumor Regions in Thermal Breast Images

We are investigating infrared thermography as a noninvasive adjunct to mammography for breast cancer screening. Thermography detects elevated skin temperatures that arise from increased blood flow as a consequence of angiogenesis. Image textures are perceived patterns, variations, and randomness across image pixels and can be quantified by texture features. Image analysis techniques, such as those used in computer-aided diagnostics, often rely on texture features to quantify disease status. It is unclear whether quantitative texture features can be used to distinguish tumorous regions from healthy tissues in thermal images, and whether they are robust across a range of patient characteristics. This study investigates the ability of 39 texture features to locate tumorous regions in thermograms of breast cancer patients.

For each patient, we used 15 manually-cropped images (one image per minute as the disrobed patient is cooling over time). Each image was divided into a square grid, where the dimensions of each grid square were varied to be 20x20, 30x30, and 40x40 pixels. We computed 39 texture features for each grid square: texture properties of the gray-level co-occurrence, Laws's texture energy measures, and first-order intensity histogram. For each texture feature, we constructed a difference image by finding the absolute difference between corresponding regions on the two breasts. For each grid square and each texture measure we computed the standard deviation (STD) across the 15 difference images to find the variability in the texture measurement over time. Squares with STD values above a specified threshold were located. We evaluated texture features by determining if one (or more) of the selected thresholded squares contained the tumor region (ground truth) of the patient.

Preliminary results from a set of patients show that grid size (area over which texture features are computed) affects the performance of texture features. Some features, such as cluster prominence, identified tumorous regions in a subset of the patients with grid size 20 by 20 pixels, but did not succeed when the grid size was increased to 40 by 40 pixels. Other features, such as skewness, identified tumorous regions in a subset of patients when a larger grid was used. To draw meaningful conclusions or observe patterns, we will test the proposed algorithm on more breast cancer patients; a pilot study is now underway. The goal is to examine the suitability of texture features for identifying tumor regions in thermal images, and possibly to isolate a subset of candidate features.

PRIMARY PRESENTER

Nada Kamona

STATUS

Student – Undergraduate

AUTHORS

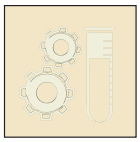
Nada Kamona

Murray Loew

RESEARCH MENTOR/ DEPARTMENT CHAIR

Murray Loew

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Towards Body-Specific Absorption Rate (SAR) Reduction Utilizing a Compact Magneto-Dielectric AMC Structure

A compact artificial magnetic conductor (AMC) structure for the application of SAR reduction is presented. A magneto-dielectric structure as a host of AMC substrate is used to miniaturize the AMC size. The magneto-dielectric has been designed with a low-profile spiral loop in a way to have a high permittivity or permeability for the desired frequency of 3.5 GHz. The reflection phase simulation result of the proposed AMC unit cell is confirmed that a reduction of 70% has achieved compared to the conventional AMC. To validate the simulation result, a prototype of the board is fabricated and measured with a CPW antenna regarding the reflection coefficient. The measurement result presents well agreement with the simulation one. A VOXEL model of a human body is used to calculate the SAR value of the proposed structure. The maximum SAR value for a 10 g average of tissue shows that more than 70 percent reduction is achieved compared to the CPW antenna without MD-AMC board.

PRIMARY PRESENTER

Reza Karimian Bahnemiri

STATUS

Student – Graduate

CO-PRESENTER

Seyed Hamed Haghshenas

AUTHORS

Reza Karimian Bahnemiri

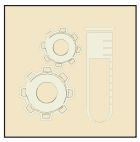
Seyed Hamed Haghshenas

Shahrokh Ahmadi

RESEARCH MENTOR/ DEPARTMENT CHAIR

Shahrokh Ahmadi

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Ultrasound-Enhanced Ciclopirox Delivery for Treatment of Onychomycosis

INTRODUCTION

Onychomycosis is a fungal nail disorder that is characterized by thick and yellow nails that can be extremely painful and lead to psychosocial issues. In onychomycosis, the fungus lives on the nail bed. Due to the poor permeability of the nail, current antifungal drugs, which are applied to the top of the nail, are unable to reliably reach the nail bed, making them ineffective in treating the fungus. The aim of our study has been to determine the efficacy of using ultrasound to increase the permeability of the nail with the goal of improving treatment success in onychomycosis.

MATERIALS AND METHODS

Two sets of ultrasonic experiments were performed using porcine nails. In both experiments, planar ultrasound transducers were used to sonicate the nails using frequencies of 400 kHz, 600 kHz, 800 kHz, and 1 MHz, an intensity of 1 +/- 0.1 W/cm^2 and a duration of 5 min in continuous mode. Both experiments also utilized a Franz Diffusion Cell Setup. In the first set of experiments - the Dye Diffusion Cell Experiments, the nail was placed above a receiving compartment that was filled with saline and below a donor compartment that was filled with a drug-mimicking blue dye. The second set of experiments—the Ciclopirox Diffusion Cell Experiments, used a donor compartment that was filled with Ciclopirox, the drug used in clinic for onychomycosis treatment, and the receiving compartment was filled with ethanol because the drug is nonpolar. The nails in the experiments were sonicated and the absorbance of the receiving compartment was measured to determine the permeation of dye through the nail.

RESULTS AND DISCUSSION

In both the Dye Diffusion Cell Experiments and the Ciclopirox Diffusion Cell Experiments, the nails were found to have more permeation at higher frequencies. In the Dye Diffusion Cell Experiments, statistical significance ($p<0.05$) was found at all frequencies, but the greatest permeation was found with increasing frequency. In the Ciclopirox Diffusion Cell Experiments, only the 800 kHz and 1 MHz experiments were found to be statistically significant ($p<0.05$), with more permeation in the 1 MHz experiment.

CONCLUSION

Our lab has recently obtained IRB approval to work with human nails, and plan to implement the Ciclopirox Diffusion Cell Experiment using these nails. If proven successful, our method may find a clinical application due to the non-invasive nature of proposed therapeutic ultrasound treatment.

PRIMARY PRESENTER

Alina Kline-Schoder

STATUS

Student – Undergraduate

AUTHORS

Alina Kline-Schoder

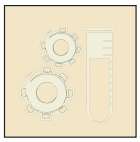
Vesna Zderic

Zung Le

RESEARCH MENTOR/ DEPARTMENT CHAIR

Vesna Zderic

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Automated Segmentation Algorithm for Thermal Breast Images

Early detection of breast cancer has been shown to be the key to higher survival rates for breast cancer patients. We are conducting a pilot study on breast cancer patients to investigate infrared thermography as a noninvasive adjunct to mammography for breast cancer screening. Tumors rely heavily on increased vascularization of surrounding tissue in order to deliver oxygen and nutrients to the growing tumor and remove waste. The resulting angiogenesis, or formation of new blood vessels, causes an increase in blood flow and activity at the tumor site. Thermography detects elevated skin temperatures that arise from this increased blood flow because of the angiogenesis that accompanies tumor growth. Although tumor regions are warmer than surrounding breast tissue, the warmest regions are located right under the breasts. Therefore, the breast region must be isolated from surrounding tissue before any further thermal analysis can be done.

In this study, breast cancer patients and healthy volunteers were imaged for 15 minutes using an infrared camera. A segmentation algorithm was then developed to automatically segment the breasts in thermal images of patients. Various edge detection methods, including the Hough transform and Canny, Sobel, and Laplacian of Gaussian edge detection were used to detect breast boundaries. A point system weighted all methods to optimize final lines of segmentation based on breast size. Sixteen of the twenty-five images were properly segmented using the created algorithm. The success of the algorithm depended on the breast size. Automatic segmentation of large breasts had an 80% (twelve of fourteen) success rate with cases properly segmented, compared to four of eleven cases of small-sized breasts. Extra checks, such as the point system, helped increase the accuracy of segmentation for small breasts.

Overall, this algorithm successfully limited the area of tumor search and reduced the time and effort needed for manual segmentation. Future work involves implementing curvature as a way to continue lines initially realized by the edge detection techniques, to improve the efficiency of the algorithm for small-sized breasts.

PRIMARY PRESENTER

Zainab Mahmood

STATUS

Student – Undergraduate

AUTHORS

Zainab Mahmood

Katharine Fergusson

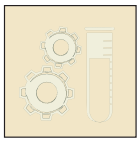
Nada Kamona

Murray Loew

RESEARCH MENTOR/ DEPARTMENT CHAIR

Murray Loew

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

3D Morphological Analysis of Biocytin-Injected Hypoglossal Neurons

Pediatric dysphagia is a condition characterized by difficulties in feeding and swallowing in infants and children. The tongue is a major structure involved in feeding and swallowing, and abnormalities in tongue control occur in patients suffering from dysphagia. Hypoglossal nerve is a cranial nerve that originates from the hypoglossal nucleus in the brain stem and innervates the tongue; it is responsible for all the motor supply of the tongue. To study the effects of dysphagia on neurons from the hypoglossal nucleus, we are using a mouse model of DiGeorge Syndrome (22q11 Deletion Syndrome) that display the feeding and swallowing difficulties seen in 22q11DS patients, mimicking a pediatric dysphagia. The goal of this research is to analyze the dendritic morphology of motoneurons localized in the hypoglossal nucleus, which have undergone electrophysiological measurements and filed with biocytin, between a control group/wild type (WT) and mice with the genes deletion (LgDel). The specific dendritic parameters that will be observed are length, branching points, straightness, and volume.

The samples are prepared after they undergo patch-clamp measurements – the cells are filled with biocytin and Alexa Fluor 647. After the samples are prepared, the images are acquired utilizing confocal and fluorescence microscopy techniques with the Leica TCS SP8 Multiphoton Confocal using single-molecule detectors. Using this microscope, we acquired overviews with the 10x objective and high-resolution 3D data sets using the 20x objective. The 3D data sets were analyzed on Imaris, a 3D visualization and analysis software; we used Imaris to qualitatively view the neurons and create 3D reconstructions of neuronal morphology. These 3D reconstructions allowed us to obtain quantitative data of dendritic parameters that were further analyzed. Initial findings suggest there is a trend that shows less complexity of dendritic branching of LgDel neurons that is an indication of changes in the afferent activity of this neurons. Our next steps for this project will be to label the motoneurons responsible for protrusion and retraction of the tongue. This will allow the researcher to correlate the morphology of a neuron to the specific function of that neuron.

PRIMARY PRESENTER

Pratik Mistry

STATUS

Student – Undergraduate

AUTHORS

Pratik Mistry

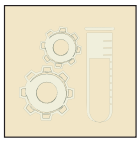
Cheryl Clarkson-Paredes

Anastas Popratiloff

RESEARCH MENTOR/ DEPARTMENT CHAIR

Anastas Popratiloff

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Symmetrical Cluster Analysis for Thermographic Breast Cancer Detection

Breast Cancer, in its early stages, is characterized by a significant increase of vascularity in the affected region, prompting blood flow and skin temperatures to increase accordingly. Prior research has indicated not only that the surface temperature of the skin is altered in the presence of a tumor, but also that the natural cooling of the skin over time does not occur at the same rate when a tumor is present. Skin temperature can be measured with a thermal camera, which is passive, fast, and non-contact, thus prompting the use of thermographic image analysis as a novel method for detecting and classifying breast cancer. By performing an assortment of image analysis procedures on these thermographic images, this research aims to develop an algorithm that identifies breast cancer development in patients to assist in physician diagnosis.

The initial goal of this study was to confirm the theoretical conclusion that tumor-affected tissue was significantly warmer than unaffected tissue in a clinical setting, which was achieved by imaging patients from the GW MFA Breast Cancer clinic over a period of 15 minutes each. Our findings indicate that in this 15-minute window, the tumorous tissue stays warmer and cools more slowly than normal, non-tumorous tissue. With this knowledge, we have developed a cluster isolation algorithm, which uses patient and volunteer (cancer-free) images and isolates pixel clusters that have high clinical significance (high correlation with cancer development). Initially, the algorithm clusters the warmest pixels based on iterative thresholding and a Density Based Spatial Clustering Algorithm (DBSCAN). Then, clusters are removed if they are deemed to be clinically unimportant based on three distinct factors: If the cluster crosses the midline, if the cluster has another cluster in a reflected position about the midline, and if the cluster lies on the bottom border of the breast. Only the clusters that pass all three isolation mechanisms are deemed clinically important.

The results from our first iteration of algorithm development indicate high validity when isolated clusters are compared with the known tumor locations (obtained from the GW MFA Clinic). As additional data are gathered, this algorithm will be adjusted appropriately to produce results with increased accuracy. The goal of this project is to provide patients and clinicians a complementary resource for early detection of breast cancer.

PRIMARY PRESENTER

Aidan Murray

STATUS

Student – Undergraduate

CO-PRESENTER

Shannon Toole

AUTHORS

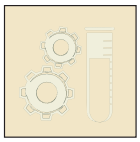
Aidan Murray

Shannon Toole

RESEARCH MENTOR/ DEPARTMENT CHAIR

Murray Loew

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Computerized Tomography Texture Analysis for Applications in Classification of Renal Cell Carcinoma

Renal cell carcinoma (RCC) is a disease in which tumorous cells grow along the tubules which make up the kidney's filtration system. The major requirement for the efficient treatment of RCC is the knowledge of its location, type, and aggressiveness, which can currently be determined only through a biopsy, an invasive procedure. Texture analysis is the process of quantifying intuitive qualities of the image, which is performed by extracting the mathematical representations of the quantitative aspects of the textures, known as features. This project aims to characterize CT scans of cancerous tumors in the kidney into 4 grades, based on aggressiveness, using Computerized Tomography Texture Analysis (CTTA).

The 38 features including gray-level co-occurrence, gray-level run-length and scale & rotation invariant textural features were extracted for the region of interest of each scan and passed through a dimensionality-reduction algorithm. The final feature vector was determined using the correlation matrix and was used to train multiple classifier models using 10-fold cross-validation; a total of 77 individual scans were used. The best classification results were observed using a k-nearest neighbor classifier model with k=1, with an average accuracy of 91.42% over 5 trials, which shows statistical evidence of successful classification. Great potential lies in the further improvement of the classifier models, including adding new scans to the dataset and including more relevant texture features to the algorithm.

PRIMARY PRESENTER

Anishsanjay Nayak

STATUS

Student – Graduate

CO-PRESENTER

Sara Ocampo

AUTHORS

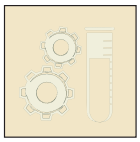
Anishsanjay Nayak

Sara Ocampo

RESEARCH MENTOR/ DEPARTMENT CHAIR

Murray Loew

BIOMEDICAL ENGINEERING



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Biosensor Development for Ubiquitin Binding Characterization

Ubiquitin is a prominent regulatory protein found in nearly all multicellular organisms. Despite being an essential component of life, there is still a lot to learn about ubiquitin's interactions with its associated enzyme classes, particularly ubiquitin-conjugating enzymes and ubiquitin ligases (E2s and E3s respectively). To discern these interactions within a timeline, an in vitro biosensor platform is being adapted using a polyhistidine tag. The biosensor's primary component is functionalized glass optical fiber. As light shines through the fiber, an instrument analyzes the surface's shifting resonant frequencies and presents the graphical information in real time. This polyhistidine tag can be attached to proteins without altering their physical or chemical interactions, including ubiquitin. A molecular complex connects the tag to the biosensor surface, creating a reusable interface. Establishing visual characterizations on this platform lays the foundation to further develop a temporal understanding of ubiquitin's interactions with its associated enzymes. At the project's completion, two specific E3 enzymes will be scrutinized for their binding behavior over time via the graphical interface. These visual characterizations require assurance that the polyhistidine tag on the biosensor platform binds consistently with its expected targets.

PRIMARY PRESENTER

Obinna Ome Irondi

STATUS

Student – Undergraduate

AUTHORS

Obinna Ome Irondi

Katharine Wright

Zhaowen Liu

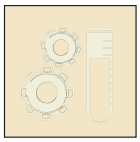
Michael Massiah

Mark Reeves

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mark Reeves

BIOMEDICAL ENGINEERING



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

A Multimodal Solution to Workplace Violence in the Hospital

Violent patient outbreaks in healthcare institutions plague hospitals across the nation. These outbreaks take a financial toll on hospital systems as well as an emotional/physical toll on healthcare providers. Poorly designed studies looking into the effects of violent patient outbreaks/workplace violence have made it difficult to truly understand the scope of the impact this problem has on healthcare providers. Our research team has come to recognize that a serious proactive solution needs to be implemented to predict when these patients will become agitated and violent. The study we have conducted takes a look at several systematic reviews of the current literature in workplace violence and proposes a novel multimodal solution to this issue. In addition, we have worked with Dr. James Phillips, the Chief of Disaster Medicine at GW, who has extensively studied workplace violence and published his finding in the New England Journal of Medicine. Our team has found new insights that add to some of the key findings to Dr. Phillips' study, while also providing information about future directions towards solving this problem. Moreover, future directions may involve something along the lines of what our research team has designed. We have devised a wristband that uses a proprietary deep learning algorithm and wearable sensor technology to create theoretical predictions of when an agitated patients will become violent. Our study has demonstrated that a proactive solution, such as the one our device will offer, will effectively mitigate the serious financial/emotional/physical damages violent outbreaks cause hospital providers and hospital systems. In collaboration with the Chief of Telemedicine at the GWU hospital, Dr. Neal Sikka, and Biophysics Professor, Dr. Lan, our device will be deployed at the GW hospital and provide insight into the current state of workplace violence in clinical settings by using well-founded data and effective research designs.

PRIMARY PRESENTER

Rohan Patil

STATUS

Student – Undergraduate

CO-PRESENTERS

Arthur Cronin

Nathalya Ramirez

Krishan Shah

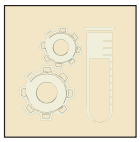
AUTHOR

Rohan Patil

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ganhui Lan

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Can Baseline Image Analysis Help in the Prediction of Radiation Therapy Efficacy in the Case of Head and Neck Squamous Cell Carcinoma?

Head and Neck Squamous Cell Carcinoma (HNSCC) is usually treated with radiation therapy (RT). We wish to study whether the heterogeneity of the tumor affects the clinical outcome after RT. A database is available that contains HNSCC images acquired in various modalities. Each image modality gives different information about the patient; we wish to test whether a combination of modalities will help to assess the likelihood of success of RT.

The computerized tomography (CT) scan image gives us anatomical information whereas the positron emission tomography (PET) scan gives us physiological information. The tumor is visible in the pre-treatment PET images. PET images have poorer resolutions than CT images, but the PET-CT imaging system ensures that the pre-treatment CT images are registered with the PET images. Thus, using the tumor information in the pre-treatment PET image, we can locate the exact position of the tumor in the pre-treatment CT image. On registering the pre-treatment CT images with the post-treatment CT images, we have the original location of the tumor displayed in the post-treatment CT image, which, in turn will give us the location of the presumably cured tumor in the post-treatment PET image.

The effectiveness of the treatment can be judged by the presence, location and size of the tumor at a particular time after the start of the treatment. This involves a study of both the pre- and the post- treatment images. Shifts are observed between the various images, however, because of factors including change in the position of the patient between the imaging sessions. Thus, image registration is important to combine the information obtained by the different imaging modalities and also to correct the shift between the pre-and post-baseline images.

The clinical data accompanying the database indicate whether there was a local recurrence of the tumor in the patient after the completion of the treatment. The patients are divided into local recurrent and non-local recurrent categories. The RT Plan, included in the database, is used to indicate the tumor boundaries in the pre-treatment PET images. Once the tumor region has been extracted, various texture measures are computed on it. Those include energy measures, moments of the tumor texture, correlation between the tumor pixels and their neighbors, Fourier measures and others. We also aim to examine whether the heterogeneity of tumor textures can be a factor that predicts the treatability of the tumor by radiation therapy.

PRIMARY PRESENTER

Apurva Singh

STATUS

Student – Graduate

AUTHORS

Apurva Singh

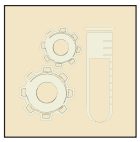
Sharad Goyal

Murray Loew

RESEARCH MENTOR/ DEPARTMENT CHAIR

Murray Loew

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Therapeutic Ultrasound-Induced Insulin Release as a Potential Treatment for Type 2 Diabetes

OBJECTIVES

Type 2 diabetes mellitus is a complicated and chronic metabolic resulting from the interplay of systemic insulin resistance of peripheral tissues, insufficient secretion from pancreatic beta cells, and insufficient beta cells due to genetic and environmental factors. The aim of this work is to study the calcium-dependent mechanisms of ultrasound-mediated insulin release and the translational potential of therapeutic ultrasound as a novel treatment for type 2 diabetes.

METHODS

INS 832/13 cells were exposed to 800 kHz 0.5 W/cm^2 ultrasound and 5 mM EGTA, an extracellular calcium chelator. The cells were loaded with Ca^{2+} dye Quest Rhod4AM and voltage-sensitive Di-4- ANBDQS to measure real-time changes in intracellular Ca^{2+} and membrane potential in response to ultrasound stimulation.

A two-dimensional finite-element model of an axial slice of the human abdomen was constructed in PZFlex based on anatomy from a reference atlas. Maximum temperature was calculated for a five minute application of continuous 800 kHz ultrasound for both pre- and post-meal conditions.

Studies with transgenic mice include terminal and survival studies to investigate the short term response to ultrasound application, including insulin, glucagon, and alpha-amylase release. In currently ongoing studies, the treatment group is exposed to 5 minutes of continuous 1 MHz 1.0 W/cm^2 ultrasound twice per week with blood samples being collected just before treatment, just after treatment, and thirty minutes after treatment.

RESULTS

Ca^{2+} imaging studies showed an increase in fluorescence intensity approximately 5 seconds after the stimulus begins (n=3). Elevations in Ca^{2+} dye fluorescence intensity were accompanied by a decline in membrane potential, which is indicative of membrane depolarization. Initial modeling results indicated that the stomach must be filled with fluid to avoid significant burning of the skin. The highest temperature observed was 41.2˚ C with a water-filled stomach. Survival and terminal studies with transgenic mice are currently ongoing. Preliminary terminal studies indicated no gross damage from 1 MHz ultrasound application at 1 W/cm^2.

CONCLUSIONS

Fluorescence imaging studies suggested a transient calcium mobilization shortly after ultrasound application begins that is inhibited by EGTA. This suggests that the release mechanism involves an influx of extracellular calcium, possibly through ultrasound-induced micropores. The initial results from finite element analysis and animal studies show promise in the translational potential of therapeutic ultrasound in the treatment of type 2 diabetes. In future studies, models will be based on abdominal computer tomography (CT) images of normal and obese patients.

PRIMARY PRESENTER

Tania Singh

STATUS

Student – Undergraduate

AUTHORS

Tania Singh

Shane Haar

Ivan Suarez Castellanos

Aleks Klimas

Emilia Entcheva

Kevin Cleary

Joshua Cohen

Diti Chatterjee Bhowmick

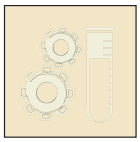
Aleksandar Jeremic

Vesna Zderic

RESEARCH MENTOR/ DEPARTMENT CHAIR

Vesna Zderic

BIOMEDICAL ENGINEERING



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Measuring the Effect of Mannitol on Myocardium Using Optical Coherence Tomography

Structural changes in the myocardium can be indicative of cardiovascular disease (CVD), and Mannitol is a drug that has been shown to swell cleavage planes within myocardial tissue and improve tissue function. Optical coherence tomography (OCT) is a non-invasive imaging modality that can be used to acquire structural images of the myocardium of mice. In this study, three-dimensional OCT images are taken of six mouse hearts, both untreated and treated with Mannitol. Various image processing techniques are applied to the images to automatically reduce noise and threshold each frame of the 3D volume. The ratio of black pixels, representing the cleavage planes inside the tissue, to white pixels represents the relative volume of the cleavage planes to the rest of the tissue. The respective ratios from the control and experimental group of mouse hearts can provide a practical comparison between the relative size of cleavage planes in each group.

PRIMARY PRESENTER

Isabel Verghese

STATUS

Student – Undergraduate

AUTHORS

Isabel Verghese

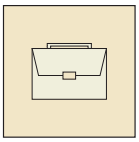
Tara Diba

Jason Zara

RESEARCH MENTOR/ DEPARTMENT CHAIR

Jason Zara

BUSINESS



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

The Impact of Project Management Methodologies on Project Success: A Case Study of the Oil and Gas Industry in the Kingdom of Bahrain

The study assessed the impact of Project Management Methodologies (PMMs) on project success across industrial companies in the Kingdom of Bahrain. Also, it explored the different project methodologies along with their strengths and weaknesses.

Quantitative approach with the support of qualitative interviews was used to achieve the objectives of this research. For the quantitative part, an adopted questionnaire was used to assess the impact of PMMs on project success. The project methodologies (comprehensive, supplemented and applied) were the independent variables and project success was the dependent variable. Further, the questions of the qualitative interviews were adopted from the literature and used to explore the methodologies along with their strengths and weaknesses.

This study revealed that comprehensive and applied PMMs have significant impact on project success whereas supplemented PMMs are not making significant contribution to the prediction of the project success. The analysis showed that one unit change in the application of relevant PMM elements throughout the project life cycle has 32.3% impact on project success whereas one unit change in the application of comprehensive PMM elements has 27% impact on project success.

Projects in the industrial sector are more about safety than speed and hence, the use of comprehensive methodologies and applying the relevant methodology elements are important. Also, a common strength point between all assessed methodologies was the involvement of a multidisciplinary team which contributes to the performance of the project. On the other hand, all methodologies were described as a time-consuming process.

PRIMARY PRESENTER

Hazem Hasan Ahmed Abdulla

STATUS

Student – Graduate

AUTHOR

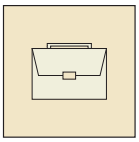
Hazem Hasan Ahmed Abdulla

RESEARCH MENTORS/ DEPARTMENT CHAIRS

Mukhtar Al-Hashimi

Michael Stankosky

BUSINESS



SCHOOL OF BUSINESS

Do Associate Analysts Matter?

Sell-side equity analysts often work in hierarchical teams. Lead analysts manage a team of associate and junior analysts, who take part in modeling future earnings, writing the analyst reports, and producing price targets and stock recommendations. We examine the relative contribution of lead analysts and associate analysts to the team's performance. We find that associate analyst fixed effects explain 17.6 percent more of the variation in forecast accuracy than lead analyst fixed effects do. In contrast, we find that lead analyst fixed effects explain 3 times more of the variation in forecast timeliness and 10.7 percent more of the variation in forecast bias than associate analyst fixed effects do. These results suggest that the decision to issue a forecast is at the discretion of the lead analyst and that lead analysts have a greater influence on forecast bias. In cross-sectional tests, we find that less experienced lead analysts explain more of the variation in forecast accuracy, timeliness, and bias compared to more experienced lead analysts. We also find that lead analysts explain more of the variation in the forecast accuracy, timeliness, and bias of the first forecast in the quarter compared to the revised forecasts. These results suggest that experienced lead analysts are less involved in EPS forecasting and that lead analysts are more involved when more information processing is required. Lastly, we find that the length of the collaboration of the lead analyst and the associate analyst improves forecast accuracy and timeliness but does not affect forecast bias. Overall, our study documents the significant role of associate analysts and their contribution to the team's performance.

PRIMARY PRESENTER

Menghai Gao

STATUS

Student – Graduate

AUTHORS

Menghai Gao

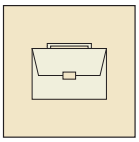
Yuan Ji

Oded Rozenbaum

RESEARCH MENTOR/ DEPARTMENT CHAIR

Oded Rozenbaum

BUSINESS



ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Islamic Financial Globalization into Non-Islamic Economic Jurisdictions: An Assessment of Shari'ah-Compliant Banking Performance in Luxembourg and the United Kingdom

This study is divided into two components. The first aims to examine how Islamic banking activities have been able to expand into non-Islamic economic jurisdictions, that is, jurisdictions where financial regulations are not systemically dictated by Shari'ah law. Specifically, I examine the Islamic banking sectors of Luxembourg and the United Kingdom, two of the world's top holding destinations for international financial investment. Although the pre-existing literature on the topic of Islamic financial globalization holds that the key tenets of Shari'ah-compliant banking are diametrically opposed to that of their conventional counterparts, both countries possess the two most viable Islamic banking sectors in the West. This paper describes the institutional development of viable Islamic banking sectors, attributable to four categories of policy reforms: fiscal, monetary, legal, and regulatory. The second component of this study aims to assess the profitability and stability of Islamic banking activities in both countries. This is executed by two measurements: the return on equity (ROE) and the return on assets (ROA). Using an aggregation of financial statements released annually by Islamic financial institutions (IFIs) in the UK and Luxembourg, I extrapolate an average ROE and ROA for each country, which is measured against the performance of conventional financial institutions (CFIs).

PRIMARY PRESENTER

Timothy Janicek

STATUS

Student – Undergraduate

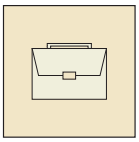
AUTHOR

Timothy Janicek

RESEARCH MENTOR/ DEPARTMENT CHAIR

Hossein Askari

BUSINESS



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Narrative Extension: The Curious Case of Brand Extension in the Film Industry

Movie sequels, prequels, spin-offs, and remakes operate as a form of brand extension within the film industry. Previous research identifies several key explanatory variables regarding the success of a given film brand extension, including genre. This research proposes an altered conception of the brand extension, which we call The Narrative Extension. Deriving insight from psychological research into narrative "transportation theory," this conception posits narrative factors as the most useful in assessing consumer branding of given films. From this, we propose The Meta-Extension, a narrative extension uniting two or more heretofore unconnected brands, as a main driver behind the dominance of extensions in the current film industry. We find evidence from the 2016 international box office to support this theory. These data also provides insight into various explanatory variables put forward by previous research. Revenue of the most recent parent film is found to possess a positive relationship with the extension's revenue. Additionally, we find that extensions with elements of science-fiction or fantasy perform more poorly than other extensions, all else equal.

PRIMARY PRESENTER

Kevin Gabriel Kearns

STATUS

Student – Undergraduate

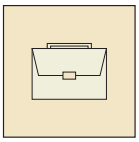
AUTHOR

Kevin Gabriel Kearns

RESEARCH MENTOR/ DEPARTMENT CHAIR

Bryan Boulier

BUSINESS



SCHOOL OF BUSINESS

What You See Is What You Get? Enhancing Methodological Transparency in Management Research

We review the literature on evidence-based best practices on how to enhance methodological transparency, which is the degree of detail and disclosure about the specific steps, decisions, and judgment calls made during a scientific study. We conceptualize lack of transparency as a "research performance problem" because it masks fraudulent acts, serious errors, and questionable research practices, and therefore precludes inferential and results reproducibility. Our recommendations for authors provide guidance on how to increase transparency at each stage of the research process: (1) theory, (2) design, (3) measurement, (4) analysis, and (5) reporting of results. We also offer recommendations for journal editors, reviewers, and publishers on how to motivate authors to be more transparent. We group these recommendations into the following categories: (1) manuscript submission forms requiring authors to certify they have taken actions to enhance transparency, (2) manuscript evaluation forms including additional items to encourage reviewers to assess the degree of transparency, and (3) review process improvements to enhance transparency. Taken together, our recommendations provide a resource for doctoral education and training; researchers conducting empirical studies; journal editors and reviewers evaluating submissions; and journals, publishers, and professional organizations interested in enhancing the credibility and trustworthiness of research.

PRIMARY PRESENTER

Ravi Ramani

STATUS

Student – Graduate

CO-PRESENTERS

Nawaf Alabduljader

Herman Aguinis

AUTHORS

Ravi Ramani

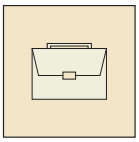
Nawaf Alabduljader

Herman Aguinis

RESEARCH MENTOR/ DEPARTMENT CHAIR

Herman Aguinis

BUSINESS



SCHOOL OF BUSINESS

Reconciling Satisfaction of Stockholders and Other Stakeholders: What is Between the Parentheses

An undergraduate student approaches a seasoned business ethics professor after the first day of class and muses, "I don't understand. My finance professors have all said that the most important objective of corporations is to maximize stockholder value and stock price. But you're saying managers have to pay attention to stakeholders without prioritizing profits." The professor smiles and explains, "I understand your confusion. But think of it this way: your finance professor is not necessarily saying that managers should maximize profits above everything else. Perhaps he or she is just saying that a manager should maximize profits in the absence of other compelling concerns." In other words, imagine that there are parentheses after the finance professor's maxim: Managers should maximize shareholder returns (after attending to other significant stakeholder concerns).

The purpose of this paper is to examine what is in the parentheses and why, and how what is in the parentheses does not conflict with maximizing shareholder value. What is in between the parentheses encompasses law, values and good common sense. First, the law plays a role. It would not make sense that managers have a responsibility to maximize profits irrespective of the law if, for no other reason, then violating the law would jeopardize profits. It is important to keep in mind that the law, particularly in the United Sates, evolves; managers need to anticipate where liability could exist tomorrow, even if not today, and protect shareholders from the cost of potential liability (as well as negative image consequences). Second, values matter. Corporations exist because they add value to society (i.e., that premise underlies their legal foundation). It would not make sense for them to exist and tread upon human values, i.e., "significant," values such as "life, liberty and the pursuit of happiness," and fundamental human rights (such as those articulated in the International Declaration of Human Rights). Finally, common sense matters. Protecting long-term value translates into making decisions that might not prioritizing short-term maximization. For example, the easiest way to increase stock price is to have massive layoffs (i.e., reduce costs). That is great for the short term; but it does not ensure that the company will be around tomorrow. Many of today's costs ultimately translate into investments for tomorrow.

Our conclusion is that "profit maximization" is a convenient shorthand, but it should not be used as a proxy for sound business judgment, which includes many additional considerations. American law does not mandate profit maximization; it just states that decisions are to be made in the interests of the stockholders. Going forward, when thinking about stockholders and other stakeholders it is important that we not forget what is between the parentheses. Paying attention to stakeholders is how good managers pay attention to stockholders.

PRIMARY PRESENTER

Alexander Ward

STATUS

Student – Undergraduate

CO-PRESENTER

James Cooper Stouch

AUTHORS

Tara Radin

Alexander Ward

James Cooper Stouch

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tara Radin

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

From First Ladies to Politicians: An Examination of Women in Politics

Eleanor Roosevelt and Hillary Clinton not only shared the title of First Lady, but also received notoriety for their ability to transcend traditional norms. Although separated by half a century, Eleanor Roosevelt and Hillary Clinton propelled themselves into the domain of national and international politics, making their political savviness and ambitions known in a male dominated world. This study examined the intriguing bond and set of experiences shared by Eleanor Roosevelt and Hillary Clinton through the lens of movement, with the intention of drawing inspiration from their political impact and legacies in the form of a choreographic work.

To do this, a seven-month long research and movement study was conducted in Washington, D.C. and Hyde Park. Textual, archival, media, and videographic research was undertaken regarding Roosevelt's and Hillary Clinton's lives before, during, and after the White House. The research was complemented by visits to the White House and Val-Kill, Eleanor Roosevelt's personal house in Hyde Park, New York. Additional research on leadership and its intersection with gender in societal, political, and economic spheres was examined to complement Eleanor and Hillary's experiences as leading women. Through two hour bi-weekly rehearsals in the Fall and Spring semesters, movement and choreographic compositions were constructed.

The result of this study was a six-minute dance piece presented at the GW Program of Theatre and Dance's Fall Dance Concert. The piece examined the relationship Eleanor and Hillary shared with politics, women, societal restraints, and the glass ceiling. The study was expanded into a twenty-four-minute dance performance presented at the GW Program of Theatre and Dance's Spring Dance Concert. The full-length work continued highlighting Eleanor Roosevelt's and Hillary Clinton's narratives, while simultaneously showcasing the timeless and transcendent challenges women face on the journey to become leaders. Taking the dance of politics and the genders, the trajectories of Eleanor Roosevelt and Hillary Clinton were examined outside their traditional perspective and reframed within an artistic context.

PRIMARY PRESENTER

Eva Gustafson

STATUS

Student – Undergraduate

AUTHOR

Eva Gustafson

RESEARCH MENTOR/ DEPARTMENT CHAIR

Dana Tai Soon Burgess

CREATIVE ARTS

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Art-Making for Teachers: How Can Art Therapy Combat Teacher Burnout?

OBJECTIVE

Human services professionals have a higher rate of burnout than most occupations. For teachers, exhaustion and stress are exasperated by increases class sizes and reduced budgets. High rates of teacher burnout can lead to high teacher turnover and early retirement rates, as well as, lower levels of behavioral tolerance in the classroom. Since art therapy can be used to help relieve stress and foster positive communication, it may be especially helpful in promoting teachers' sense of wellness and expressing the burdens of teaching.

METHOD

A one-time workshop conducted with a group of teachers in a Christian school in the Midwest U.S. incorporated art therapy protocols to investigate the benefits of art making. The teachers created 1) art about the upcoming school year and 2) response art to another participant's artwork. Participants completed a questionnaire about their process for creating each piece of artwork and joined a discussion about the overall process.

FINDINGS

The workshop explored feelings of isolation and stress, along with feelings of relief and empathy for others experiencing similar feelings as evidence by the themes that arose in the art, questionnaires, and discussions. Thematic analysis revealed six major themes throughout the original and response artwork: stress responsibility to educate, empathy, acknowledging differences, relying on God, and support.

IMPLICATIONS

This workshop demonstrated the effectiveness of art making for increasing support amongst teachers and fostering communication about problems in the school. Participants felt more comfortable conveying their concerns through artwork. In addition, participants felt heard and supported as fellow teachers responded to their concerns and needs visually. The results of this workshop show that art making infused with art therapy protocols can be an effective tool for helping teachers express concerns and receive support as a way to help combat burnout.

PRIMARY PRESENTER

Christina Hagemeier

STATUS

Student – Graduate

AUTHOR

Christina Hagemeier

RESEARCH MENTOR/ DEPARTMENT CHAIR

Jordan Potash

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Beyond Football and Basketball: High School and College Sports Participation, Socioeconomic Background, and College Selectivity

Research suggests that participation in high school organized extracurricular activities is strongly associated with social class, and that participation will also influence postsecondary plans. Drawing mainly on cultural capital theory, the debate has either focused on the associations between social class and activity participation, or the role that cultural orientations play in extracurricular participation. The purpose of this correlational study is to examine the relationship between socioeconomic background and college matriculation for high school athletes who are involved in non-revenue generating sports (i.e., not football or basketball) using data from the Educational Longitudinal Survey (ELS:2002). This analysis will examine intercollegiate athletic participation at two levels of college attainment: the first level will look at any four-year college or university; the second stage will look at athletes at the most elite or selective institutions. For both institutional groups, characteristics such as socioeconomic status, gender, participation in varsity high-school sports and outside sports training will be analyzed. Data analysis will begin on March 1, 2018. Conclusion based on this study and recommendations for future research are made.

PRIMARY PRESENTER

Leanne Davis

STATUS

Student – Graduate

AUTHOR

Leanne Davis

RESEARCH MENTOR/ DEPARTMENT CHAIR

Rita Kirshstein

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Course Evaluations: A Way of Feedback or Feeding Bias?

Course evaluations play an important factor in the process of the tenure and promotion of a professor. Administrators question whether or not course evaluations are beneficial due to bias. In order to make course evaluations more effective, it is important to determine the advantages and disadvantages to form recommendations. Recommendations include the value of a peer review, as well as re-evaluating the content and format of questions.

PRIMARY PRESENTER

Natalia Dempsey

STATUS

Student – Graduate

AUTHOR

Natalia Dempsey

RESEARCH MENTOR/ DEPARTMENT CHAIR

Andrew Sonn

EDUCATION

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

What's in a Name?: Name Use and Authority in Classroom Settings

There is extensive literature on classroom management, the processes and procedures necessary to ensure that classes run smoothly. There is no one agreed-upon method of classroom management, and teachers take a variety of philosophical approaches. Much of classroom management is dependent on the language that teachers use to address their students and convey their point. One central aspect of this is their use of student names. The use of student names is a prominent feature of teachers' address, but it is virtually unseen in the literature on classroom management. This project focuses on the contexts in which student names are invoked in a classroom setting by teachers, and by their fellow classmates. This project works off of literature that suggests names are central to identity formation and expression, and are therefore important to analyze in the context of classroom management. Names are an aspect of the classroom that are hidden in plain sight—they are used every day, but have yet to be critically analyzed.

To evaluate how names were being used in the classroom, this project analyzed data from a middle-school science classroom. Transcript and video data from one semester were analyzed according to a typology of interactions. Each interaction was marked with one or more classifications, depending on the context. There are six aspects to the typology, each indicating a different type of interaction: acknowledgement, authorization, hailing, reproach, reference, and instruction. Every interaction involving a student's name—about 8000 in total—will be classified and evaluated. Preliminary findings suggest that teachers primarily use names in the context of acknowledgement, which frequently occurred when taking attendance, or hailing, in which a teacher directed a student's attention back to the task at hand. Students used each other's names differently; they typically used names in a referential context. The findings will also be analyzed based on dimensions of gender and race, exploring whether the context of name use varies along racial or gender lines.

This project fills a gap in the literature on classroom management by addressing the use of names for the first time, and opens the door for further research on the topic. Further research could address the same topic using a classroom headed by a female teacher, or could look at the role that the difficulty of a name's pronunciation may play in its use.

PRIMARY PRESENTER

Mackenzie Fusco

STATUS

Student – Undergraduate

AUTHOR

Mackenzie Fusco

RESEARCH MENTOR/ DEPARTMENT CHAIR

Joel Kuipers

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

The Importance of Integrating Immigrant Populations into the Greater Society: The Japanese Case Study

Japan has had a long history of keeping a closed border and has slowly been integrating non-Japanese populations into their society. With the desire to become a player in the increasingly globalized world as well as their shrinking work force, Japan is relying more on immigrants and their relationships with the minority populations to support these initiatives. The three largest immigrant populations in Japan come from Korea, China, and Brazil. Despite their existence in Japan spanning over at least 3 generations if not more, these populations still face a significant amount of discrimination and prejudice from the Japanese people.

The purpose of this study is to explore what Japan has done to help integrate these immigrant communities as well as offer suggestions to decrease discrimination and social inequality of these communities through the education system. These suggestions will be based on a comparative study of immigrant population integration in Canada, Germany, and Brazil.

Data gathering will consist of mainly a literature review tracking the history and treatment of immigrants in Japan, highlighting ways they have been accepted as well as the challenges they face in their effort to assimilate to Japanese society. The suggestions to achieve a quality education and decrease inequality for these immigrant populations will be framed in the context of the UN's Sustainable Development Goals (SDGs). Using the UN SDGs as a framework to measure progress, aligns directly with Japan's vision to be a role model to the world in the implementation of these goals.

PRIMARY PRESENTER

Arielle Gousse

STATUS

Student – Graduate

AUTHOR

Arielle Gousse

RESEARCH MENTOR/ DEPARTMENT CHAIR

Meggan Madden

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

A Foundational Descriptive Quantitative Study: The Trait Emotional Intelligence of College and University Presidents

Higher education is an immense sector with more than 20.4 million students, 4 million employees including 1.6 million faculty members, and estimated aggregate expenditures exceeding $400 billion not including the for-profit institutions. Colleges and universities are among our nation's most important social institutions, knowledge generators, and economic drivers, and have a vital role in the shaping of our global world. There are intense external and internal factors, and many stakeholders with diverse and often competing perspectives, with which college and university presidents must effectively engage in their critical leadership role.

This research identified and described the trait emotional intelligence of college and university presidents. The study was grounded in the functionalist paradigm. Core components of the theoretical framework were the trait emotional intelligence theory (Petrides & Furnham) and the concept of effective leadership (Kouzes & Posner). Using a census strategy and survey research design, 300 presidents participated and completed the TEIQue-SF. Key findings and conclusions included: (1) the majority of college and university presidents have high well-being, self-control, emotionality, and sociability factor and global trait emotional intelligence, (2) the majority of college and university presidents have higher emotional intelligence than the general population, (3) the majority of college and university presidents demonstrate leadership effectiveness, and (4) there are opportunities to enhance trait emotional intelligence in a subgroup thus leadership effectiveness of a subgroup.

The new empirical knowledge about the emotional intelligence of college and university presidents provides a foundational springboard for future research to elucidate and expand knowledge in the areas of authentic leadership, charismatic leadership, the full range of leadership (transformational/transactional), leadership effectiveness, and higher education. Also, this new knowledge may be helpful to learning more about how to work with loosely coupled systems, change organizational culture, identify and deal with perceived resistance to change, and leadership development (Burke, 2011). Findings of this study may be beneficial to college and university presidents, boards of trustees/regents, search firms, higher education associations, and consultants.

The study achieved a large study sample. Strategies contributing to the successful recruitment of the large sample are described and are transferable to other studies—especially dissertation research—and other study populations.

PRIMARY PRESENTER

Ronna Halbgewachs

STATUS

Student – Graduate

AUTHOR

Ronna Halbgewachs

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michael Marquardt

EDUCATION

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Teacher Satisfaction and Community Schools In Colorado Public Schools

There have been many studies centered on the positive behavioral and academic outcomes of public schools operating under a community school theory as they pertain to students, but the experience of teachers within those arenas has largely been left out (Heers, Van Klaveren, and Massen Van den Brink, 2016). Additionally, there has been a lack of solid evidence regarding the effectiveness of community schools when focusing on teachers. This study, therefore, seeks to fill the gap that comes from the lack of teacher voices being heard within research. Community schooling is a methodology that seeks to make resources for the community easily accessible within the school building outside of school hours. According to Heers, Van Klaveren, and Massen Van den Brink (2016), community schools have reflected more overall academic success for the students who attend them. For this study, a qualitative, semi-structured interview process is being used to speak to teachers directly about their experience and satisfaction within the career, specifically in community schools. The interviews will be coded and re-coding, seeking emergent themes from which the results interpreted accordingly. It remains to be seen what the overall results will be, but there are many potentially positive impacts to be seen in elevating the voices of teachers within community schools. This study intends to better understand the experience of the teachers within Community Schools in Colorado.

PRIMARY PRESENTER

Daniela Maria Harton

STATUS

Student – Undergraduate

AUTHOR

Daniela Maria Harton

RESEARCH MENTORS/ DEPARTMENT CHAIRS

Emily Morrison

Linda Byington

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Internationalization Efforts In Japanese Higher Education: A Case Study

The Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) is in the midst of an ambitious nationwide initiative to internationalize Japanese institutes of higher education. These efforts include: recruiting international student to Japanese universities; increasing Japanese student mobility; providing undergraduate and graduate level instruction in English; and, developing international partnerships with universities throughout North America and Europe. In order to achieve these programmatic goals, MEXT has developed a series of benchmarks and timelines by which to measure the success of the initiative.

This study examines how one university in Tokyo is trying to achieve the goals of this ambitious national program. Through qualitative research methods, the study explores how the programs and goals established by MEXT are impacting the work of university administration. In addition to the faculty and staff, the study focuses on the experience of the graduate students themselves, to form a fuller picture of how national education efforts to internationalize are experiences by by local student and international students.

This research will provide valuable insight to how programs, developed by government at a national level, are executed at individual universities and how these efforts are experienced by students.

Field research was conducted through the generous support of The Kakehashi Project and GW's Graduate School of Education and Human Development faculty.

PRIMARY PRESENTER

Anna Hertlein

STATUS

Student – Graduate

CO-PRESENTER

Jeffrey Ramos

AUTHORS

Anna Hertlein

Jeffrey Ramos

RESEARCH MENTOR/ DEPARTMENT CHAIR

Meggan Madden

EDUCATION

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Student Acquisition of Science Skills and Learning Objectives in an Introductory Biology Laboratory Course

One of the main goals of education in biology is to not only teach students what they should know about biology, but how it came to be known; namely, through laboratory (lab) practices. It may be of interest to explore whether these students are connecting these two types of knowledge. The current study examined the responses to two prompts, "What is the purpose of this lab?" and "Name two Science Skills you utilized during this lab and tell how you used them," given to 10 undergraduate students enrolled in an introductory biology laboratory course at The George Washington University. The results showed that around 70% of students knew the purpose of the lab. Furthermore, the two most common Science Skills used were Observing and Analyzing, and most of the responses encoded fell under the category of '4' of the rubric, indicating the highest level of complexity in the response. However, the next most common response fell under the category of '2', demonstrating a marked gap between students who could connect concepts learned in lecture to laboratory practices, and those who could not. More research is needed to explore the reason for this gap and how to shift it in the direction of a category '4.'

PRIMARY PRESENTER

Madison Long

STATUS

Student – Undergraduate

AUTHOR

Madison Long

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Donaldson

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Online Student Retention: Intangible Students' Need for Tangible Resources

In Fall of 2015, 14.4% of all degree-seeking post-secondary students were enrolled in online-only programs (*The Chronicle of Higher Education*, 2017). However, studies have shown that online student retention rates are as low as 50-60% (Gravel, 2012). Current research shows that efforts to increase retention are minimal at best. The theory behind this study is drawn from research that focuses on the experience of online-only students in higher education as it relates to the retention rates for that population, as well as those studies encompassing retention in general. Many practitioners and researchers have tackled this subject from various perspectives inrecent years. Research was drawn from studies and articles published within the last 10 years, in either peer- reviewed journals or from nationally recognized higher education organizations and publications (American Council on Education or T*he Chronicle of Higher Education*, for example). The main factors that contribute to online-only student retention are a strong sense of community among students (Dunworth, 2012; Sutton, 2014; Mannay & Wilcock, 2015), engaging interactions with faculty and staff (Gravel, 2012; Sutton, 2014; de Freitas, 2015), and strong writing skills (Sutton, 2014). Going forward, practitioners can anticipate the biggest challenges in online student retention to be addressing student underpreparedness for the rigor of a degree program, finding ways to foster community from afar, and aiding students with computer literacy skills. **Increased retention for online students will lead to higher success rates in accessible higher education opportunities for diverse and widespread students; therefore, it is of utmost importance to specifically target online students in retention efforts across higher education.** A poster presentation will be followed by time for questions and/or discussion..

PRIMARY PRESENTER

Rebecca Nolan Lynch

STATUS

Student – Graduate

AUTHOR

Rebecca Nolan Lynch

RESEARCH MENTOR/ DEPARTMENT CHAIR

Andrew Sonn

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

The Impact of Legacy Based Admissions on Campus Climate

"The label of being a legacy applicant influences greatly the college application process" (Mayo, 2017). Although many universities recognize that legacy status plays a role in deciding if an applicant will be accepted, some commentators, including noted politicians, argue that admissions committees should not look at legacy status at all (Schmidt, 2004). This program argues for the eradication of legacy admits because of the benefits in creating a well-rounded incoming class for the entire student body (Mayo, 2017). All student should be held to the same admissions standards, regardless of legacy status (Mayo, 2017). In turn, the campus learning environment for all students is enhanced in terms of learning outcomes.

PRIMARY PRESENTER

Erin Mayo

STATUS

Student – Graduate

AUTHOR

Erin Mayo

RESEARCH MENTOR/ DEPARTMENT CHAIR

Andrew Sonn

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Understanding the Experiences of Growth-Oriented Women Entrepreneurs: A Portraiture Study

While women entrepreneurs have significantly contributed to the US economy, they have been depicted as being smaller, having less profits, concentrating in low-profit sectors, and generating fewer jobs than their male counter parts (Blank et al., 2010; Hughes, Jennings, Brush, Carter & Welter, 2012; Marlow, 2014; Minniti & Naude, 2010 U.S. Department of Commerce Economic and Statistics Administration, 2010). There is a need for research that avoids the traditional view of women entrepreneurs as disadvantaged (Marlow, 2014).

The purpose of this qualitative portraiture study is to understand the essence of US-based growth-oriented women entrepreneurs' experiences in growing their businesses by centering women's ways of knowing in the male normative environment of entrepreneurship. The study explores the following research question: How do growth-oriented women entrepreneurs understand their experiences in growing their organizations within a male-normative environment of entrepreneurship? Related sub-questions are: How do women entrepreneurs identify and use facilitators to grow their businesses? How do women entrepreneurs describe the experience of acquiring knowledge, skills, and abilities (KSAs) needed to grow their businesses?

This study examines women entrepreneurs' experiences from an appreciative inquiry perspective; a key tenet of portraiture methodology. Rather than looking for the deficiency in the women entrepreneurs' experience, it searches for "the good" (Lawrence-Lightfoot & Davis, 1997). The ontology that guided this study was social constructivism (Creswell, 2013; Crotty, 1998; Guba & Lincoln, 1989); an epistemology based on women's way of knowing (Belenky et al., 1986); and portraiture methodology.

The portraits of the three women entrepreneurs were assembled into a gallery. These stories were organized into categories that were analyzed across participants to determine where emergent themes reveal patterns (Lawrence-Lightfoot & Davis, 1997) and were presented as the study's findings. The final layer was my interpretations of the women entrepreneurs' stories presented in poetic form. The findings of this study include six themes: women's entrepreneurial experiences, characteristics, learning, reflections on gender, knowing, and self as knower. Conclusions on the experience of women entrepreneurs' growth within the normative environment of entrepreneurship along with implications are presented.

PRIMARY PRESENTER

Andrea Richards Scott

STATUS

Student – Graduate

AUTHORS

Andrea Richards Scott

Maria Cseh

Julia Storberg-Walker

Lionel Howard

RESEARCH MENTOR/ DEPARTMENT CHAIR

Maria Cseh

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Teaching With Tech: An Observational and Exploratory Study Examining the Use of Technology in Japanese Schools

The ability to use technology in a variety of ways is essential in today's society. The Sustainable Development Goals and Incheon Declaration outlined by the United Nations state that "education systems must be relevant and respond to technological advances." Technology is also a defining factor of development and can be used to promote global citizenship. Due to this, the use of technology in education has become a goal of many countries around the world. Japan is one of these nations that is putting forth policy to ensure their citizens stay just as technologically literate as their competitors.

Japan is a nation that ranks very high across all subjects on international assessments. They are also a society known for their technological advances. However, their classrooms and teaching methods are still quite traditional. This qualitative study looks at the current use of technology in Japanese secondary schools and at higher education institutions based off of our experience in the country. Currently around the world, programs are being put in place to use technology to increase cross cultural communication, making the word that much more connected and learning more accessible. Technology is also used to support student learning in new ways. We hope that the successful programs we outline through this research will help to put policy about technology in education into practice in Japan.

PRIMARY PRESENTER

Emily Silverberg

STATUS

Student – Graduate

CO-PRESENTER

Hannah Reedy

AUTHORS

Emily Silverberg

Hannah Reedy

RESEARCH MENTOR/ DEPARTMENT CHAIR

Meggan Madden

EDUCATION

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Using Social Emotional Learning to Teach Stem

Social emotional learning (SEL) has proven successful in students of different races, socioeconomic statuses and other diverse factors, demonstrating a potential role in closing the education and gender gap, according to researchers such as Brakett, et al. (2010). Further, some studies have shown that components of SEL, like helping and working with others, have inspired students to pursue STEM courses and careers (Fuesting, Diekman and Hudiburgh, 2017). So far, there have been gaps in research to demonstrate how SEL implemented in STEM coursework and instruction might be affecting student learning, specifically, for middle school and high school students. This study is designed to demonstrate how DC Public School 6–12 teachers are implementing SEL in their STEM classes. Currently, DCPS is adapting the five competencies for SEL developed by the Collaborative for Academic, Social and Emotional Learning (CASEL) to their SEL implementation agenda. Therefore, this study will specifically explore how teachers are implementing these five competencies in their classrooms and seek to discover which ones appear to be most effective in actively engaging students in material and advancing their persistence through challenging material. Data will be collected through teacher interviews using the snowball sampling method. Data will then be coded and analyzed for themes that may demonstrate trends, indicating how the implementation of the SEL competencies is influencing student learning in STEM courses. In addition, discovering which competencies seem to be most effective may help to inform administrators and teachers more fully about how to approach and implement SEL in their STEM classes.

PRIMARY PRESENTER

Nadia Syed

STATUS

Student – Undergraduate

AUTHOR

Nadia Syed

RESEARCH MENTOR/ DEPARTMENT CHAIR

Emily Morrison

EDUCATION

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Graduate Students in a Hybrid Histology and Cell Biology Course

INTRODUCTION

In a world that is becoming increasingly dependent on technology, the implementation of online and computer resources has permeated graduate medical education. These technological advances have necessitated the evolution of curricula and reformatting of class structure. In particular, histology and cell biology teaching have been highly influenced and are in a state of flux in various graduate and medical curricula. A growing trend is that many institutions are now offering an online resource of digitized histological images as opposed to the traditional glass light microscope preparations. Previous studies have reported equal if not improved performance and benefits of these online histology and cell biology resources such as slide consistency, flexibility, ease of use, and efficiency of faculty time. An online, interactive histology atlas has been developed for undergraduate, graduate, and medical students at George Washington University in Washington, D.C. This online resource offers numerous digital preparations at both light and electron microscope levels in reference to the in-class teaching syllabus of the clinically relevant organ, tissue and cell systems. The atlas teaches both structure and proper identification techniques, and also offers accompanying texts containing background information and image clarification. Furthermore, the online resource offers testing and labeling practice to enhance the learning process. The purpose of the study is to examine the efficiency, perception, and helpfulness of the online resource in a new course format.

METHODS

We evaluated such measures by anonymously surveying the 2016 fall cohort of graduate students in George Washington University's Graduate Certificate of Anatomical and Translational Sciences (GCATS) and Masters of Anatomical and Translational Sciences (MATS) programs. Practical exam grades were also reviewed to assess learning of the material.

PRELIMINARY RESULTS AND CONCLUSIONS

A preliminary survey found that 66% of students thought the atlas very useful, 75% stated the online laboratory exercised to be an effective use of time, and 100% mentioned the online component enhanced their learning of the material. Students scored very well on the final practical exam in the course. Given the feedback from our survey, combined with other studies' findings, we hope to implement changes to make the online laboratory more effective for student use and to enhance the overall learning dynamic for cell biology and histology.

PRIMARY PRESENTER

Husayn Tavangar

STATUS

Student – Graduate

AUTHORS

Husayn Tavangar

Gisela Butera

Lindsay Friedman

Anna Ren

Rosalyn Jurjus

RESEARCH MENTOR/ DEPARTMENT CHAIR

Rosalyn Jurjus

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Tales of a Black Colonial: The Foggy Bottom Edition

Drawing upon current and archival literature of the experiences of individuals within non-white and indigenous communities who confronted injustice, as well as existing knowledge of hermeneutic phenomenology and narrative inquiry, this qualitative research explores the colonial impact of former President George Washington's legacy on non-white and indigenous identity development at The George Washington University.

It is a known fact that George Washington was a slave master. He was a product of his environment. He only granted his slaves freedom after his death (in his will), and yet congress felt implored to found this great school of thought after him—a community made up of diverse thinkers and dreamers. However, this also begs the age-old question, who is free? Who is allowed to think and question? And furthermore, who is silenced? This is the foundation we were built upon. And now, almost 200 years later, we are attempting to redefine our space in the educational sphere. It is the case that several education systems globally were built on the backs of slaves or dictated by colonial masters. I wish to explore The George Washington University as a case study of this phenomenon, specifically how knowledge of this paradox affects non-white and indigenous students today.

Based on evidence from my experience as a bi-cultural master's student in the Graduate School of Education and Human Development, and current research being conducted by the George Washington University's Working Group for Slavery and Its Legacies, findings support Wa Thiongo's "Decolonising the Mind" epistemology which calls for a resistance of the dominant narrative and a dismantling of repeated pedagogical injustices for non-white and indigenous communities, globally.

For generations, the schooling system has taught these communities to assimilate, but never to speak truth to power. This research seeks to uncover how non-white and indigenous communities, locally and globally, can reimagine academic spaces, redefine the flow of knowledge production, resist the dominant narrative and construct their own decolonized solution. Taken together, results of the study will inform research on identity development for indigenous and non-white students at the George Washington University, and will provide decolonizing solution alternatives that seek to liberate indigenous and non-white students from having to embrace the colonial archetype found in eurocentric schooling systems. Furthermore, this study will benefit local and global education practitioners and increase non-white and indigenous students' overall experience on campus.

PRIMARY PRESENTER

Nenelwa Tomi

STATUS

Student – Graduate

AUTHOR

Nenelwa Tomi

RESEARCH MENTOR/ DEPARTMENT CHAIR

James Williams

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Promoting Environmental Education and Sustainable Development Lessons in Primary and Secondary Schools in Japan

Environmental education is defined as education on understanding the environment as a whole and bringing awareness to the issues related to the environment and development. It aims to develop knowledge about environmental issues and the skills needed to benefit the environment and influence attitudes and behaviors that enable sustainable living. Environmental education teaches students and their communities how the natural environment functions and what actions need to be performed to protect our planet. Unlike most countries, Japan integrates environmental education into core subject areas and special activities that remove the need for a separate class to teach students about the environment. Students learn the importance of the environment and raise their environmental consciousness within the country and around the world. Although this helps the students apply knowledge about the environment to real-life situations, most students only become aware of current environmental issues rather than those with long-term implications.

The purpose of this research is to promote environmental education lessons in primary and secondary schools by planning classroom sessions that help Japanese students understand climate change and sustainable development. This research will analyze the essential environmental viewpoints being mentioned in each subject and the best practices on environmental education for Japanese teachers to use in classrooms as well as education for sustainable development being imparted in primary and secondary schools. The research will also focus on achieving goal 4.7, which ensures quality education needed to promote sustainable development by 2030 in the context of the UN's Sustainable Development Goals. The findings of this study mainly consist of a literature review on comparative curriculum analysis and best teaching practices on environmental education. This review examines best practices in primary and secondary schools in Iceland that will help students evaluate information and points of view to make informed, self-guided decisions.

PRIMARY PRESENTER

Jonathan Yoo

STATUS

Student – Graduate

AUTHOR

Jonathan Yoo

RESEARCH MENTOR/ DEPARTMENT CHAIR

Meggan Madden

EDUCATION

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Case Study Analysis: Examining Japan's Structural Barriers to Female Labor Participation in the Workforce

A key message we continue to hear over and over again from international organizations like the World Bank and UN is that formal education is key to transforming women's position and economic outlook in society. While education is critical to women's empowerment, education alone is not sustainable to achieving gender equality and empowerment. This is not the case for Japan. Although Japanese women are among the most highly educated in the world, Japan is lagging behind other developed nations in gender equality. As many as 70 percent of women leave the workforce after having their first child and only 7 percent women in Japan hold senior leadership roles. Why? What is the root cause? The objective of this research study is two-folded: one is to explore Japan's structural bottlenecks and barriers to closing gender gap, achieving gender equality (SDG 5), and increasing female labor participation in the workforce from a social-cultural lens. Two is to understand what the Japanese government is doing to increase women's empowerment. According to Dr. Nelly Stromquist, social change requires the synergy of four critical dimensions of empowerment: economic, political, psychological, and knowledge/cognitive. Given the complexities behind gender inequality, this paper seeks to apply Stromquist's empowerment framework to dissect the factors that drive inequality in Japanese society, understand how they are interconnected, and provide a holistic picture of what's hindering women's career advancement. Japan currently faces a number of critical social issues: shrinking workforce, declining birthrate, and aging population. By understanding the social context behind gender inequality issues in Japanese society, policymakers can better tackle Japan's demographic challenges and establish policies to narrow the gender gap in the workforce. As a result, this will increase Japan's female labor participation to create a more prosperous economy.

PRIMARY PRESENTER

Joy Zhou

STATUS

Student – Graduate

AUTHOR

Joy Zhou

RESEARCH MENTOR/ DEPARTMENT CHAIR

Meggan Madden

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Computational Geometric Identification for Qaudrotor Dynamics in Wind Fields

Quadrotor unmanned aerial vehicles have been envisaged for various applications, such as aerial manipulation, transportation, and construction. To operate quadrotors in an outdoor environment safely, it is critical to understand the effects of wind gusts precisely and mitigate them. However, it is challenging to precisely model the complicated dynamics of multiple rotors coupled with the wind field. Also, it is challenging to estimate the strength and the direction of wind fields in which quadrotors operate. The wind information is useful to compensate its effects in autonomous flights.

Another challenge in system identification of quadrotors is that dynamics of a rigid body evolve on the nonlinear configuration space, referred to as the special Euclidean group. System identification for the attitude dynamics is often studied in terms of Euler-angles or quaternions. There exist singularities and complexities in formulating sensitivities of attitude trajectories in terms of minimal representations or quaternions, thereby fundamentally restricting the performance of system identification. Recently, the authors have proposed an intrinsic formulation of the system identification for the attitude dynamics directly on the special orthogonal group.

This paper aims to construct a computational framework for the system identification for the coupled translational and rotational attitude dynamics of a rigid body. This is applied to identify the parameters of the wind effects on the quadrotor dynamics. Then, the resulting dynamic model of the quadrotor is utilized to estimate the wind velocity.

The proposed identification scheme is based on a structure-preserving geometric numerical integrator, referred to as a Lie group variational integrator on the special Euclidean group, and the sensitivities of the coupled trajectories of the quadrotor to the unknown parameters are formulated directly on the special Euclidean group. Consequently, the proposed scheme avoids the singularities or complexities inherent to minimal attitude representations or quaternions, and it is guaranteed that the estimated computational trajectories of the quadrotor remain on the special Euclidean group at every iteration. Numerical examples illustrate that the presented methods successfully identify the wind effects even for the challenging case of large initial estimation errors.

As such, the computational system identification scheme presented in this paper is particularly useful to estimate unknown parameters through nontrivial maneuvers for the challenging cases of large uncertainties. In short, the proposed global, intrinsic formulation of the system identification for the quadrotor dynamics in a wind field, with explicit considerations on the numerical implementation is the main contribution of this paper.

PRIMARY PRESENTER

Mahdis Bisheban

STATUS

Student — Graduate

AUTHORS

Mahdis Bisheban

Taeyoung Lee

RESEARCH MENTOR/ DEPARTMENT CHAIR

Taeyoung Lee

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

HCN4-GCaMP8 Mice Useful for Optically Mapping Conduction System of Heart

Optical mapping is an incredibly valuable and widely used experimental tool in cardiac electrophysiology. It provides the unique opportunity to study monophasic action potentials of the isolated beating heart with high spatial and temporal resolution. It is made possible by the incorporation of voltage-sensitive dyes (to measure changes in the cell membrane potentials), calcium dyes (to measure the cellular activity of the myocardium), and excitation-contraction uncouplers (to remove excess motion from physical heart beats). Overall, optical mapping is a very useful tool for revealing spatial and temporal changes of cardiac action potentials in the development of heart failure, arrhythmias, metabolic diseases, and the like; however, this experimental technique relies on the injection of fluorescent dyes in ex vivo Langendorff-perfused hearts, and it is up to the researcher to manually process signals of interest. A newly developed mouse by the Cornell Heart Lung Blood Resource for Optogenetic Mouse Signaling Lab (CHROMus) uniquely expresses the genetically encoded calcium indicator GCaMP8 under control of the HCN4 promoter, directing expression to the sinoatrail (SA) node and the atrioventricular (AV) node of the heart and the nervous system. GCaMP8 responds to calcium levels in the cell, so when calcium increases, a conformation change occurs and fluorescence increases. This mouse is useful for examining calcium signaling in the conduction system of the heart. We have incorporated this mouse into our colony at GW as a new method for optically mapping calcium transients in the beating heart, without the need for injecting artificial fluorescent dyes to optically map monophasic action potentials. This mouse is the first of its kind to be proven beneficial for intrinsically mapping calcium handling of the SAN with high spatial and temporal resolution.

PRIMARY PRESENTER

Jaclyn Brennan

STATUS

Student – Graduate

AUTHORS

Jaclyn Brennan

Igor Efimov

RESEARCH MENTOR/ DEPARTMENT CHAIR

Igor Efimov

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Development of a Solar Photocatalytic Reactor for Sustainable Water Purification

As lack of access to clean drinking water continues to be a problem, especially in rural areas and developing countries, the challenge of finding innovative ways to treat drinking water in secluded areas with few resources must be met. Additionally, the presence of persistent and emerging organic micropollutants and pathogens further challenges the safety of treated water. A potential solution is the solar-energy-enabled photocatalysis, a sustainable advanced oxidation process that can destruct organic micropollutants and inactive pathogens. Because operating a photocatalytic reactor can be solely dependent on renewable solar energy, the process is sustainable and can be used in areas where electricity and chemicals are not readily accessible.

The purpose of this research project is to develop a solar photocatalytic reactor for sustainable water purification. Among various types of photoreactor designs, the compound parabolic collector (CPC) design was chosen due to its capability to collect high solar radiation at any angle of acceptance, its ability to operate on industrial scale applications, and its low fabrication, operation, and maintenance costs. Titanium dioxide (TiO2) photocatalysts were loaded on glass beads, and used for the photoreactor. The effectiveness of the photocatalyst for the degradation of pollutants was tested, by using methyl orange as a model contaminant under ultraviolet light irradiation. Based on the results, the photocatalytic beads were effective in degrading the methyl orange. In addition to the development of the photocatalyst, we applied 3D printing to fabricate a solar reflector in the CPC. Future work on this project will include the use of another promising yet underexplored photocatalyst, graphitic carbon nitride, which can harvest more visible sunlight to enhance photocatalytic performance. Additionally, the type, geometry, and operational parameters of the reactor will be tested in order to optimize reactor performance.

Overall, the goal of the project is to find the optimum CPC design and promote the practical application of solar photocatalytic water treatment technology for rural areas and developing countries. The project has the potential for broad impact, as it can be adapted for many locations and situations.

PRIMARY PRESENTER

Yoon Sil Choi

STATUS

Student – Undergraduate

CO-PRESENTER

Kayla Tarr

AUTHORS

Yoon Sil Choi

Kayla Tarr

Danmeng Shuai

Qinmin Zheng

RESEARCH MENTOR/ DEPARTMENT CHAIR

Danmeng Shuai

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Recognizing Images of Eating Disorders with Deep Learning

Eating disorders (ED) are pervasive and do not discriminate based on race, religion, gender, or socioeconomic status. Comorbidities include anxiety, depression, substance abuse, self-injurious behaviors, and history of trauma. ED are often a lifelong struggle, with approximately 2/3 of patients never achieving a full and sustained remission.

Exposure to media expressing "the thin ideal" can be triggering to individuals with ED as well as those at risk for developing them. Social media is rife with these triggers. Concurrent with the rise of social media, individuals with ED have created communities in which they support one another in the dangerous pursuit of this illness' goal: to be "thin enough." Websites promoting anorexia (pro-ana) and ED as lifestyle choices valorize acting on ED symptoms. Such sites teach those suffering or at risk from ED how to act on the illness and support them in doing so, putting them at risk for severe health complications.

The impact of images in this community far exceeds that of other communities surrounding physical and mental health issues. Therefore, it is essential that clinicians and family members be able to identify websites containing images associated with the promotion of ED to prevent exposure to these triggers. This research aims to automatically detect such triggering material, with the ultimate goal of designing parental and clinical controls.

We report on a proof of concept, machine learning approach to identify pro-ana content, trained on example data from online social media searches. The training data was chosen to compare pro-ana content with other content similar in demographics and photographic style, composed of the hashtag-based categories #proana, #selfie, #ootd, and #greek.

We randomly chose 20% of these images as test data and train the Resnet Deep Learning neural network to classify the remaining images. On test data this gives 81% classification accuracy—a significant improvement over chance (25%). These proof of concept results suggest that it is feasible to automatically detect social media sources with triggering material, informing the creation of tools that can assist clinicians and family members to improve health outcomes.

We used the classifier to make a web application that assesses how pro-ana a social media user's content is. The tool, designed for clinicians, allows them to enter a social media username and then gives an analysis of that user's online presence, classifying its content. The tool also displays a hashtag similarity map showing trending hashtags closely related to #proana.

PRIMARY PRESENTER

Samsara Counts

STATUS

Student – Undergraduate

AUTHORS

Samsara Counts

Lulwah Alkulaib

Justine-Louise Manning

Robert Pless

James Harnett

Hong Xuan

Rebecca Begtrup

David Broniatowski

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Pless

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Video-Level Binocular Tone-Mapping Framework Based on Temporal Coherency Algorithm

To deal with the problem that low-dynamic range (LDR) displays cannot present enough contrast and details, and high-dynamic range (HDR) displays are too expensive for general public use, the image-level binocular tone-mapping framework was proposed in 2012.

When extending from this image-level system to a video-level system, however, a new problem—the temporal coherence—must be addressed. As each frame in a video is processed separately and no temporal coherency is taken into account, the results can be quite disturbing for rapidly-varying dynamics in a video. This project proposes a new framework to solve this problem, by integrating the existing image-level framework and the temporal coherency algorithm.

The method begins by processing the video analysis operator is processed to calculate two characteristics, key video value K_V and current frame value K_F, of the input HDR video. Then each frame of the HDR video is tone mapped by the photographic tone reproduction operator with a user-defined exposure, and modified by a post-processing operator. The result can be output as the left LDR video of the LDR video pair. Next, the HDR video frames are tone-mapped by the same tone-mapping operator but with a different user-defined exposure, and modified by the post-processing operator to create the right LDR video frames. Each processed right LDR frame and its counterpart left LDR frame are tested by the binocular viewing comfort predictor (BVCP). If this LDR video frame pair cannot pass the BVCP, an iteration that increases or decreases the right exposure will be implemented until a qualified right-frame image can be generated.

Finally, in all final right exposures, we find the one that is the nearest to the fixed left exposure, and begin a final iteration to regenerate the right LDR frames and combine them into a video. This video will then be output as the right LDR video of the LDR video pair. In experimental tests for the new proposed framework, the ability of preserving the object perception and the relative levels of brightness are tested. The experimental data show that this proposed new framework can effectively solve the temporal coherency problem and generate binocular LDR videos without disturbing effects.

PRIMARY PRESENTER

Mingyue Feng

STATUS

Recent Alumni

AUTHORS

Mingyue Feng

Murray Loew

RESEARCH MENTOR/ DEPARTMENT CHAIR

Murray Loew

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Energy Materials Analysis for Additive Manufacturing by Selective Laser Melting

This research aimed to improve selective laser melting (SLM) of energy materials for thermoelectric power generation devices. Thermoelectric generators are solid state devices that offer the potential for waste heat recovery in combustion and heat process systems. These devices are currently being manufactured using bulk material processing with many integration and assembly steps, leading to decreased product efficiency and high manufacturing costs. Selective laser melting is an additive manufacturing technique, when combined with semiconductor powder offers a solution to these manufacturing challenges.

Using the imaging software FIJI and optical microscopy preliminary data on the morphology (circularity, convexity, particle size distribution) of bismuth telluride and magnesium silicide was established. This data showed that both circularity and convexity of these powders will need to be improved before being implemented into the SLM process. High energy ball milling will be tested with varying parameters, ball to powder ratio, grinding speed and duration as well as pause intervals. The centrifugal and high impact forces of this mill will be utilized to improve the powder morphology as well as the flowability. A powder spreading rig, which will be used to do SLM, was created. It was built through redesigning a 3D printer by reprogramming the microcontroller to guide the axial movements as well as an additional motor and microcontroller were added to guide the powder through the system.

PRIMARY PRESENTER

Rachel Gray

STATUS

Student – Undergraduate

CO-PRESENTER

Devin Jessup

AUTHORS

Rachel Gray

Devin Jessup

Saniya LeBlanc

RESEARCH MENTOR/ DEPARTMENT CHAIR

Saniya LeBlanc

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Wake Produced by Multiple Vertical Axis Wind Turbines

Wind turbines are one of the most important sources of renewable energy. One alternative to the classical horizontal axis wind turbine (HAWT) is the vertical axis wind turbine (VAWT). While a HAWT is an effective way to gather renewable energy, there are several drawbacks. HAWTS are tall, loud, and expensive (partially due to material costs/size). A VAWT produces less noise than a HAWT. A VAWT wind farm can also outperform a HAWT wind farm in terms of power density. VAWTS are also smaller, and can be arranged in such a way to take advantage of wake and increase power density to an even greater magnitude. While some research exists on wake behavior, little is known about how different rotational configurations affect the wake following multiple VAWTs. This research aims to better quantify how airflow will change based on several variables.

The flow was studied by looking at scaled-down VAWT models in a laboratory setting (a wind tunnel). The actual values a VAWT farm might see in the real world were simulated using dimensionless parameters such as tip speed ratio and Reynolds number. Particle Image Velocimetry (PIV) was used to quantify the wake caused by the VAWT.

As this experiment is ongoing, the results are preliminary. The turbines were counter-rotated in sync, counter-rotated out of sync by 60°, and counter-rotated with no phase relation.

Perhaps the most interesting discovery thus far is the minimal effect rotational configurations have on streamwise velocity. While running the turbines in-sync vs. out of sync produced different wake structures, the streamwise velocity after the turbines was almost identical.

This research is important because it could greatly improve the efficiency of wind farms through informing wind turbine gridding.

PRIMARY PRESENTER

Raymond Hummels

STATUS

Student — Undergraduate

AUTHORS

Raymond Hummels

Colin Parker

Megan Leftwich

RESEARCH MENTOR/ DEPARTMENT CHAIR

Megan Leftwich

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Bridging the Programmability Gap: From Laptops to Supercomputers

Computers are used in myriad disciplines for purposes including modeling, simulation and data analytics. However, increasing problem sizes and complexities necessitate using much computational power that is unattainable by a personal computer. Supercomputers can typically be used for such demanding tasks.

Programming supercomputers are notoriously difficult compared to personal computers. The most important characteristic that makes them hard to program is the distributed nature of the data and the processing elements. Supercomputers are sets of highly optimized (hardware- and software-wise) computers connected via a high-speed local network. As fast as the network may get, processors that access remote data always suffer from significant latencies compared to accessing local data. Therefore, programmers need to devote time to orchestrate data movement alongside the computation.

Many potential users of supercomputers, such as domain scientists and engineers, however, either do not have enough time to spend on optimizing their algorithms or lack enough experience. Moreover, in their use cases, computation is a tool rather than a purpose. Therefore, agility of computational development can enable such users to focus on more important tasks and quickly find solutions to complex science and engineering problems.

In this work, we aim to bridge the programmability gap between personal computers and supercomputers. Our approach is three-pronged:

- Modeling the data movement: We model the data movement as an engineering process instead of a monolithic optimization. We define subtasks and stakeholders (programmer, compiler and runtime system) involved in data movement and create an ontology to specify pieces of knowledge that need to be used by stakeholders to achieve optimal data movements.
- Designing a novel language feature: Using our model, we redefine the labor distribution for data movement to reduce programmer's burden. We design a language feature where programmers can specify access patterns easily, and language system can manage details of data movement.
- Implementing an assistive tool: We design a tool which can help programmers generate logs of accesses and present them in a user-friendly fashion. It augments the programmer capabilities to understand access patterns in their applications.

We show that the language feature we propose can achieve more than 100x speedup over unoptimized code and outperform laborious manual optimization. This speedup is achieved by adding very few lines of code to the unoptimized version. We believe that the insights we discovered can help design programming languages that reduce time to solution significantly.

PRIMARY PRESENTER

Engin Kayraklioglu

STATUS

Student – Graduate

CO-PRESENTER

Tarek El-Ghazawi

AUTHOR

Engin Kayraklioglu

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tarek El-Ghazawi

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Real-Time Shape Reconstruction for Near-Earth Asteroid Landing

Small solar system bodies, such as asteroids and comets, are of significant interest to the scientific community. These small bodies offer great insight into the early formation of the solar system. Of particular interest are those near-Earth asteroids (NEA) which inhabit heliocentric orbits in the vicinity of the Earth. These easily accessible bodies provide attractive targets to support space industrialization, mining operations, and scientific missions. Furthermore, these asteroids are of keen interest for more practical purposes. The recent meteor explosions in 2002 over Tagish Lake, Canada or over Chelyabinsk, Russia in 2013 are clear evidence of the risk of asteroid impacts on the Earth. These asteroids, which released an energy equivalent to 5 kt of TNT, are estimated to strike the Earth on average every year [1]. Larger bodies, such as the 60 m object that exploded over Tunguska, Russia in 1908, release the energy equivalent to 10 Mt of TNT and will occur on average every 1000 years. In spite of the significant interest in asteroid deflection, and the extensive research by the community, the operation of spacecraft in their vicinity remains a challenging problem.

RESEARCH QUESTION

In this work, we develop an orbit and landing scheme for spacecraft onto an asteroid. The main objective is to construct the coupled equations of motion of a rigid spacecraft about an asteroid. This accurate dynamic model is then used to derive a nonlinear controller for the tracking of a landing trajectory. In contrast to much of the previous work, we explicitly consider the gravitational coupling between the orbit and attitude dynamics. In addition, we utilize a polyhedron potential model to represent the shape of the asteroid, which results in an exact closed form expression of the gravitational potential field [4, 5]. In order to determine the shape of the asteroid, we model a laser ranging sensor (LIDAR) on a maneuvering spacecraft. The LIDAR is able to provide depth measurements of the surface of the asteroid. Given a set of depth measurements it is possible to compute the shape, and hence gravitational potential of the asteroid. Computing the shape of the asteroid on a continual basis avoids the long delay and computational complexity of current asteroid operations. Furthermore, the updated gravitational model enables a spacecraft to autonomously transition from a mapping orbit directly to landing.

PRIMARY PRESENTER

Shankar Kulumani

STATUS

Student — Graduate

AUTHOR

Shankar Kulumani

RESEARCH MENTOR/ DEPARTMENT CHAIR

Taeyoung Lee

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Multiwalled Carbon Nanotube Conductive 3D Scaffolds for Differentiation of Mesenchymal Stem Cells into Schwann Cell-Like Phenotypes

In recent years, carbon nanotube based materials have been widely studied as a promising material to stimulate nerve regeneration. In this study, we integrated a novel carbon nanotubes-gelatin methacrylate composite scaffold with electrical stimulation for improving of mesenchymal stem cell (MSC) differentiation into Schwann cell-like phenotypes. Our results showed that multi- walled carbon nanotubes (MWCNT) incorporated gelatin methacrylate has an improved mechanical strength as well as cell adhesion. Double-stranded DNA facilitated homogeneous dispersion of MWCNT within the hydrogel scaffold, resulting in improved conductivity of the scaffold. More importantly, MSCs cultured on conductive carbon nanotube scaffold with electrical stimulation show increased Schwann cell marker expression. The results demonstrate the potential of the carbon nanotube scaffold coupled with electrical stimulation for promoting neural differentiation of MSCs for nerve regeneration.

PRIMARY PRESENTER

Se-Jun Lee

STATUS

Student – Graduate

AUTHORS

Se-Jun Lee

Lijie Grace Zhang

RESEARCH MENTOR/ DEPARTMENT CHAIR

Lijie Grace Zhang

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Perforation of Cell Membranes Using Encapsulated Microbubbles in the Presence of Ultrasound

Ultrasound waves are pressure waves capable of transporting energy into the body as they are absorbed relatively little by tissues. Their non-invasive, safe and painless transmission through the skin makes them suitable for use in drug delivery and gene therapy applications. Ultrasound in the presence of microbubbles facilitates transportation of drugs. These FDA approved encapsulated microbubbles (contrast agents) were initially developed for enhancing the contrast of ultrasound image. Contrast agents can carry and transport drugs or genes to the desired site through injection inside the bloodstream. They consist of a gas core encapsulated by a layer of protein or lipid to stabilize them against dissolution. Ultrasound wave excites the microbubbles making them implode (collapse) resulting in the release of drug/gene into the desired tissue. In addition to the role of microbubble as a drug carrier, in this study we aim to show that the collapse of microbubble forms or even increases the size of the small pores in the cell membrane. This can allow the transfer of DNA/RNA into the cell for gene therapy. It can also help to facilitate the uptake of drugs and large molecules into the cells. It can even help delivering drugs to cells with tight junctions like blood brain barrier by increasing the permeability of the cells. We also show that not only the collapse of these bubbles can help perforating the membranes, but their repeated pulsation also creates shear stress on membranes and perforates them. These bubbles will pulsate repeatedly if the excitation ultrasound pressure is not high enough to make them implode.

PRIMARY PRESENTER

Nima Mobadersany

STATUS

Student – Graduate

AUTHORS

Nima Mobadersany

Kausik Sarkar

RESEARCH MENTOR/ DEPARTMENT CHAIR

Kausik Sarkar

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

When Human Trafficking Is Reality: Leadership of Safety

A challenge in creating a safe community is an absence of leadership.

In the past five years, 89 million people experienced some form of modern slavery from periods of time ranging from a few days to the whole of five years. In 2016, an estimated 40.3 million people were victims, of which 24.9 million were victims of forced labor. Debt bondage affected half of all victims of forced labor imposed by private actors (ILO 2017).

There are more slaves than at any time in human history (McNally 2015).

Terrence McNally finds, "It is not about owning people like before, but about using them as completely disposable tools for making money" (McNally 2015).

In 2014, $8 billion in labor costs were saved by US private households not paying or underpaying forced domestic workers.

The UN 2030 Agenda for Sustainable Development is uncovering organized crime, illicit markets and political economies, and financial flows in respect to the achievement of safety and productivity of women and children in poverty and political instability. Illicit markets require examination of supply chains and private demand (Global Initiative 2017).

71% of modern slavery victims are women and children, and one in four victims is a child under the age of eighteen (ILO 2017).

Advances in illicit trade and cyber activity necessitate legal attention to victim identification in cases of political disappearance and detention.

Human trafficking advocates are starting to tackle the ethical complexities of forced labor within technological innovation and entrepreneurship. Exploitative conditions and human slavery require leadership mature in its ability to tell the truth in governance, international development and the private sector.

Preventing this crime is the ultimate strategy. Employment of survivors ensures safety and independence while removing financial and legal hardships.

As an issue of domestic and sexual violence, there is a time urgency. Situations escalating to extreme burden are forms of destructive targeting.

The accountability of reviewing safety and security measures includes case evidence, witnesses and the reporting necessary to save lives from negligence and repeated sexual offenders.

How will a community respond in accepting the real terms of human trafficking abuses?

The detection, debate and commitment requires action planning. Leaders must be able to recognize marketplace concepts of reality in contrast to human rights defenses and the social protection of vulnerable children and adults.

PRIMARY PRESENTER

Jehan Mondal

STATUS

Student – Graduate

AUTHOR

Jehan Mondal

RESEARCH MENTOR/ DEPARTMENT CHAIR

Shahram Sarkani

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Pulsatile Flows in a Curved Artery Model

Due to the importance of understanding behavior of blood flow in curved arteries, we experimentally modeled the flow of blood analog fluids through curved vessels. The curvature deviates the primary flow and causes the formation of helical motions inside the vessels, i.e. vortices. These vortices play important roles in hemodynamics and can affect mixing of different blood components and wall shear stress inside the artery. Therefore, understanding of the dynamics of these vortices is important. There are some characteristics that can affect the vortices in vessels e.g. rheological properties of the blood analog, vessel wall properties (rigid/elastic), and geometry of vessel. We investigate the morphology of vortical structures inside curved vessels under different conditions and aim to portray a complete picture of their evolution in 3D space.

In order to investigate the effect of different parameters on vortices we used a canonical 180° curved vessel geometry. The rigid models were machined from an acrylic block. To fabricate the more complex elastic models we developed an injection molding method to produce optically clear elastic vessels from silicone. Our working blood-analog fluid is a mixture of water and glycerin to match the viscosity of blood. Viscoelastic and shear-thinning properties of blood were simulated by adding Xanthan gum. The refractive index was perfectly matched to that of the vessel to minimize distortion for imaging with our optical diagnostics. To produce the required variable pulsatile flow rates, an adaptive feedback PID controller was developed that automatically adjusts the input to the pump to match the desired flow rate waveform. Particle image velocimetry (PIV) was used in all experiments to measure the velocity fields inside the curved vessel. After obtaining the velocity data, vortices were detected using the d_2 vortex identification method with an in-house Fortran code and vortex circulation analysis was performed.

Our findings have resolved conflicting viewpoints in the scientific literature concerning the effects of complex fluids and effect of vessel wall elasticity. Our published results provide justification for using simple Newtonian fluids in rigid geometries as opposed to using more complex fluids in elastic vessels. These simpler models capture all the relevant flow physics and are simpler to construct, and are more amenable to optically-based measurements. Also, we showed that the effects of local elasticity on morphology of vortices are less important compared to dominant effect of geometry and torsion. Therefore, this justifies the use of simple rigid models with realistic geometry.

PRIMARY PRESENTER

Mohammad Reza Najjari

STATUS

Student – Graduate

AUTHORS

Mohammad Reza Najjari

Michael W. Plesniak

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michael W. Plesniak

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Ultrasound and Lipid-Coated Microbubbles for Bone Tissue Engineering on 3D-Printed Scaffolds

Every year, roughly 6 million people are admitted into hospitals with bone related injuries or diseases, and that number is expected to rise. Current therapies are costly and inefficient making new therapeutic interventions desired. 3D printing tissue engineering methods have been shown to be promising strategies with the ability to create patient specific tissue constructs the patient's stem cells. Ultrasound has been shown to enhance bone healing through all stages. Gas-filled microbubbles encapsulated with lipids and other surfactants are highly responsive to ultrasound, which has led to their effective role as ultrasound contrast agents. In this study, we used lipid-coated microbubbles (MB) prepared in-house to better harness the beneficial effects of ultrasound stimulation on proliferation and osteogenic differentiation of human mesenchymal stem cells (MSCs) within 3D printed poly(lactic acid) (PLA) scaffold. A significant increase in cell number ($p<0.001$) was observed with low intensity pulsed ultrasound (LIPUS) treatment in the presence of 0.5 % (v/v) MB after 1, 3 and 5 days of culture on scaffolds. MSC proliferation was also enhanced up to 12% after 5 days of culture in presence of MB and LIPUS while this value was only 6% when excited with LIPUS alone. Our 3-week osteogenic differentiation results demonstrated that combining LIPUS with MB significantly enhanced both Alkaline Phosphatase Activity and extracellular calcium depositon. Alkaline Phosphatase Activity increased up to 25% after three weeks when treated with LIPUS with MB. Calcium Deposition increased up to 10% after three weeks when treated with LIPUS and MB, and only 6% with LIPUS alone. Therefore, integrating LIPUS and MB appears to be a promising strategy for enhanced MSC growth and chondrogenic and osteogenic differentiation for potential tissue engineering and regeneration therapies.

PRIMARY PRESENTER

Jenna Osborn

STATUS

Student – Graduate

AUTHORS

Jenna Osborn

Mitra Aliabouzar

Xuan Zhou

Raj Rao

Lijie Grace Zhang

Kausik Sarkar

RESEARCH MENTOR/ DEPARTMENT CHAIR

Kausik Sarkar

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Flow Characteristics and Functionality of Porous Gill Rakers Used in Silver Carp Filter Feeding

This study focuses on the method of filtration employed by Hypophthalmichthys molitrix, also known as the silver carp, when feeding. The silver carp is an extremely efficient filter feeder and invasive species that primarily uses a part of its anatomy called the gill rakers (GRs) to capture food. The structure of the silver carp GRs is completely unique to its species. Whereas other fish may have comb-like GRs for filtration, the silver carp possesses sponge-like, membranous GRs that are able to filter particles as small as 4 microns in diameter. This effective filter feeding has allowed the silver carp to outcompete native species and threaten the ecosystem of the Mississippi River and its tributaries, as well as potentially threaten the Great Lakes.

Despite its ability to filter out minute food particles from water which comprises larger particles, sediment, and mud, the silver carp's GRs do not appear to clog with use over time, which is highlighted by the fish's effectiveness in feeding. This has been corroborated by microscopy and dissection work already completed by the GWU Department of Biological Sciences. The highly effective filtering efficiency of the silver carp and its innate anti-clogging capacity provide tremendous potential for bio-inspired industrial and biomedical applications. This technology has potential to be translated over a wide range of engineering applications from waste water treatment to filtration in the food industry.

Several series of experiments, have been performed to test our hypothesis that permeation through the silver carp gill raker membranes is likely driven by an active pumping mechanism rather than a passive system. The primary pumping would be performed by a series of muscles in the roof of the silver carp's mouth known as the palatal folds. A laboratory-scale pumping mechanism has been designed and created as a simplified model of the silver carp filtering system. Flow visualization and hydrodynamics measurements have been performed using this model in addition to excised tissue samples to better understand these unique filtration dynamics.

PRIMARY PRESENTER

David Palumbo

STATUS

Student – Graduate

AUTHORS

David Palumbo

Kartik Bulusu

Isaac Finberg

Samantha Racan

Megan Leftwich

Michael Plesniak

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michael Plesniak

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Understanding LENR Via the Simulation and Measurement of Electrochemical Cells

In the early 1990s, multiple researchers found they could produce heat in an electrochemical cell by using nickel cathodes and carbonate solutions in light water solvents. The heat was attributed to nuclear reactions. Since then, scientists have not been able to consistently reproduce those results. The phenomenon in which energy is generated within an electrochemical cell has been titled Lattice Enabled Nuclear Reactions, also called Low Energy Nuclear Reactions (LENR). Such reactions provide a new method to produce clean energy without significant prompt radiation, radioactive waste, or greenhouse gases.

We are seeking to reproduce, control and understand LENR by a three-prong program of laboratory measurements, data analyses and multi-physics simulations. In order to quantify the heat produced by LENR, resistive heating in the electrochemical cells must be understood through experimentation and simulation. Temperature changes within an electrochemical cell are measured as a function of time by one thermocouple inside a hollow cathode within a cell and one thermocouple in the atmosphere above the cell. An infrared camera is used to obtain temperature data on the surfaces of the cell.

The simulations provide temperature information at all points within and on the cells at any time. They are being done by using COMSOL multiphysics finite-element commercial software, specifically, with the AC/DC electrical and Heat Transfer modules. The geometry is built within COMSOL, and materials are specified for the geometry. Once the geometry and materials are defined, an applied voltage produces fields and currents. The ionic currents in the electrolyte cause resistive heating. It is the background thermal behavior on top of which we simulate the production of heat by LENR. The thermal effects of LENR are simulated by applying an extra heat source on the surface of the cathode within the electrolyte.

We perform simulations as a function of time by varying two major parameters, the voltage applied to the cell (in the range of 0.5 to 5.0 V) and the electrolyte chemistry (Li, Na, K and Rb carbonates). The simulated temperatures obtained by using the AC/DC and Heat Transfer modules are significantly higher than those we measure. That is due to not yet having the energy required for electrolyzing (splitting) water in the simulations. Hence, we are now using an alternative approach with the COMSOL Electrochemical and Heat Transfer modules. Our work provides the most sophisticated simulations now being done in the study of LENR.

PRIMARY PRESENTER

Gabriel Papadatos

STATUS

Student – Undergraduate

AUTHORS

Gabriel Papadatos

Zach Awtry

Emma Gutzmann

David Nagel

RESEARCH MENTOR/ DEPARTMENT CHAIR

David Nagel

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Mucosal Waves in Self-Oscillating Synthetic Vocal Fold Models

The objective of this research is to assess the ability of one- and two-layer self-oscillating synthetic vocal fold models to replicate physiological vocal fold motion within an experimental apparatus in the Biofluid Dynamics Laboratory. The research specifically aims to determine under what conditions a mucosal wave develops in the models. To produce speech, the initially closed vocal folds open when a critical lung pressure is reached. Air is forced through the vocal folds causing them to undergo self-sustained oscillations. When critical lung pressure is reached, the lower section of the vocal fold deforms, followed by a deformation of the upper section after a slight time delay. The lower section begins to close after the air passes over it due to the decrease in pressure and elasticity of the vocal fold. This cycle of offset deformation of the upper and lower vocal fold repeats forming the mucosal wave. The mucosal wave is an essential part of healthy voice production and visualizing it can help to diagnose speech-related disorders.

Homogeneous one- and two-layer were fabricated based on the standard M5 geometry. Materials were selected to match the properties of the different human vocal fold layers. The vocal fold models were tested using an *in vitro* vocal tract. The vocal tract has interchangeable inserts that replicate the effects of throat and mouth shape for different vowel sounds. The initial experiments were performed with the neutral (schwa) vowel tract. High-speed images were captured with an IDT NX4 high-speed camera and MotionStudio at 2500 fps to investigate vocal fold motion.

Many voice disorders can only be diagnosed by visualization. This process was traditionally done using high-speed videos played at slow speeds, which was very time-consuming. Videokymography is a technique wherein single lines in each high-speed image frame are stacked together into a single image showing the vibration at one point in the vocal fold. This process takes significantly less time than traditional methods and is equally useful in analyzing voice production.

Using a MATLAB code, the high-speed video images were converted into kymographs and analyzed to observe the mucosal wave. The kymographs did not clearly show a mucosal wave in one- or two-layer models. The mucosal was not expected in one-layer models based on previously reported studies, while previous research concerning the mucosal wave in two-layer silicone models has been inconclusive. More realistic synthetic VF models are being developed and evaluated using the techniques developed in this program to determine if a mucosal wave phenomenon is produced.

PRIMARY PRESENTER

Philip Paulson

STATUS

Student — Undergraduate

AUTHORS

Philip Paulson

Elizabeth Hubler

Kartik Bulusu

Michael Plesniak

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michael Plesniak

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Investigation of Polymeric Scaffold Degradation for Bone Regeneration Applications

3D-printed polymeric scaffolds are being used for allografting in applications such as bone regeneration, particularly in treatment of maxillofacial and craniofacial defects. Osseous tissue growth and extracellular matrix formation is the desired outcome of the scaffold implants. However, the success and efficacy of this treatment modality is limited by the mechanical structure failure due to pulsatile neovascular flow conditions and mechanical stresses. The research question addressed in this study concerns the mechanical structure changes and the fate of material diffusion and transport in these scaffolds. The main goal of this study that is seldom addressed in literature is to ascertain the time-scales of scaffold degradation that are essential to achieve osseous tissue growth and vascular formation.

The research question was addressed by monitoring scaffold degradation of polyvinyl alcohol (PVA) scaffolds, which are soluble in deionized (DI) water and cell medium (CMPVA) solution used in mesenchymal stem cell (MSC) cultures. The experimental protocols included direct and indirect measurements. In order to establish a benchmark for future experiments, we report measurements pertaining to PVA-scaffold degradation without cellular crosslinking. Direct monitoring of macroscopic mechanical structure of the PVA-scaffolds was achieved using a simple digital microscope camera. Subsequently, the mechanical structure changes were also observed under constant flow rate conditions. Raman spectroscopy techniques were used to establish intensity changes in the vibrational frequencies of the O-H and C-H stretching modes in the PVA scaffolds at particular stages in the deformation. Indirect measurements were made with a rheometer (Discovery HR-2,TA instruments) wherein the variation of viscosity of the medium was assessed due to increase in PVA concentration. Since the degraded solute (PVA) diffuses into the medium (DI water and CMPVA) and is transported into the flow stream, diffusivity was measured using a Polson Cell apparatus.

The results project the PVA-scaffold degradation time to be between 1 to 6 hours depending on the design, diffusivity and solvent used. Extended measurements using mesenchymal stem cell cultures are planned in the near future using cell counting methods and spectrophotometry. These experiments have tremendous potential to impact our understanding of scaffold-degradation for applications such as maxillofacial and craniofacial repair.

PRIMARY PRESENTER

Samantha Racan

STATUS

Student – Undergraduate

CO-PRESENTER

Isaac Finberg

AUTHORS

Isaac Finberg

Samantha Racan

Kartik V. Bulusu

Michael W. Plesniak

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michael W. Plesniak

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Breaking the Boundary Between Optical Communication and Optical Computing

The evolution of the human computing power has never stopped, however, the observed pace of the semiconductor industry is notably slowing down especially since the 14 nm technology node transistors. This is driven by physical limitations in the information processing units, as one part of the computing power, relating to leakage current, on-chip power budget, thermal dissipation density, and non-circumventable fabrication process control. With the electronic computing system become more constrained by the aforementioned limitations, optical replacements have been demonstrated recently in both data processing and communication with the potential of breaking through the electronic energy barrier with wavelength division multiplexing (WDM).

We break down the problem into three parts: 1) adapting hybrid photonic-plasmonic technology into fundamental computing engines; 2) building hybrid photonic-plasmonic on-chip communication networks components such as interconnects, routers and transceivers with mutual capability; 3) applying the computing unit to the on-chip optical networks and finding a holistic figure-of-merit (FOM) for overall performance evaluation among different technologies as well as using it as a guideline for system reconfiguration.

Here we demonstrate a prototype of a complete optical computing system solution from the logic devices and problem solvers to network related routing components and fundamental on-chip network applications. We show the benefit of keeping the data signals within optical domain during the whole system with over an order of magnitude energy efficiency improvement and the ability to dynamically reconfigure based on the traffic patterns and applications. Moreover, by hybridizing the photonics with plasmonics, these hybridized devices integrated on-chip effectively connect the optical logics to the optical network which tend to mitigate the power and heat dissipation challenges, and even extending data bandwidth with the potential of breaking through the electronic energy barrier with the unique parallelism feature of light.

PRIMARY PRESENTER

Shuai Sun

STATUS

Student — Graduate

AUTHORS

Shuai Sun

Jiaxin Peng

Ruoyu Zhang

Tarek El-Ghazawi

Volker Sorger

RESEARCH MENTOR/ DEPARTMENT CHAIR

Volker Sorger

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

M13 Bacteriophage Alignment in the Presence of an Electric Field

Smectic helicoidal nanofilament (SHN) structures are desirable in phage self-assembly because they can create a passive, color-changing sensing system. This ability helps to overcome the obstacles in current sensor fabrication techniques, including complex and expensive design procedures, single target systems, and the need for an on-board power supply. Therefore, on the road to commercialization, self-assembling bacteriophages are advantageous for fabricating sensors that detect the presence of toxins and other hazardous gases.

The LeBlanc group is addressing methods to achieve SHN structures using highly-ordered M13 bacteriophage. In the field today, the only known method of phage assembly is a Langmuir-Blodgett coating technique, colloquially termed the "pulling method." This method involves pulling a small substrate out of a solution of the sensing material at a 90° angle at a speed of 20-80μm/min.

Fabricating a 50mm long sensor a pulling speed of 80μm/min, a single sensor would take over 10 hours to manufacture. This demonstrates a large obstacle for commercializing sensors using this sensing material. This limitation initiated a collaboration between labs at The George Washington University and Korea University, where the KU lab engineered sensing solutions that the lab at GW manipulated to force self-assembly, with the goal of fabricating color-changing sensors.

The technique under study in the group is derived from an assembly technique used to align T4 bacteriophage. In previous research using a close relative to the M13 bacteriophage, an alternating electric field showed successful results in aligning the T4 bacteriophage. Here, sensors detecting the presence of E-coli were fabricated quickly by manipulating the electrical properties of bacteriophage. Specifically, the polar organisms aligned themselves so that the negatively charged heads aligned on a substrate with an applied voltage, leaving the slightly negative tails open for sensing applications. We applied the same technique to the M13 bacteriophage to determine if an alternating electric field applied to the substrate would result in SHN phage structure. Through application of an electric field, SHN bundles of bacteriophage giving off distinct color change were observed, demonstrating a promising step in achieving color changing sensors in a matter of minutes as opposed to hours, a key factor in commercializing this technology.

PRIMARY PRESENTER

James Tronolone

STATUS

Student — Undergraduate

AUTHORS

James Tronolone

Wonbin Song

Michael Orrill

Byung Yang Lee

Saniya LeBlanc

RESEARCH MENTOR/ DEPARTMENT CHAIR

Saniya LeBlanc

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Machine Learning for High-Performance, Energy-Efficient, and Reliable NoCs

With continued aggressive technology scaling, Network-on-Chips (NoCs) architectures are facing three major challenges including minimizing power consumption, scaling performance and providing a reliable and robust communication limited by area, power, and cost constraints. Researchers have proposed various techniques individually tackling these challenges, while few efforts to date have simultaneously targeted improving power, performance, and reliability together. Due to the complexity of the interactions among three competing objectives and explosion of design space, it is harder to manually design rules and strategies for interconnection system for optimizing power, reliability, and performance.

In our research, we use Machine Learning (ML) algorithms, which can work with high-dimensional data and automatically infer complex decisions, to balance reliability, performance, and energy efficiency for NoCs. We first use supervised ML algorithms to build predictive decision models, which can optimize competing goals of two of the three targets (e.g. reliability and performance, performance and power, etc.). We further use reinforcement learning (RL) to eschew the prediction step and automatically learn a decision policy that directly maps system-level states to optimal decisions which can yield maximum benefits on reducing power, enhancing reliability, and improving performance simultaneously.

PRIMARY PRESENTER

Ke Wang

STATUS

Student — Graduate

AUTHOR

Ke Wang

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ahmed Louri

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

MODetector (Mod): A Dual-Function Optical Modulator-Detector for On-Chip Communication

Electronic device scaling in modern microsystems has lead to system limitations mainly driven by challenges in signal communication, but also fundamental challenges such as quantum tunneling. Although new emerging options including photonics and plasmonics have recently been investigated to overcome the interconnect and communication bottleneck, the fundamental energy efficiency of optical logic devices is still been limited to fJ level due to weak non-linearity. Rather than focusing at the logic level, reducing the energy cost in data communication via both optoelectronic component and architecture improvements is a viable option. While augmenting network on chips (NoC) with photonic links enables high-bandwidth communication, the overhead for photonics is rather large, mainly driven by bulky footprints and the multi-functionality of transceivers. The latter requires, in addition to a photon source, signal modulation and detection. If a NoC were photonically augmented at every network point to enable all-to-all connectivity, the resulting photonic overhead would be excessive. Besides, the high bandwidth of a single optical bus may be sufficient to supply the networks data-sharing demand. Spatial signal routing is a necessary function of data communication in NoCs. However, if photonic links are used to augment electronics, an energy-costly optical-electrical-optical (OEO) conversion is required since routing is currently executed in the electronic domain. Here we show a novel integrated broadband hybrid photonic-plasmonic device termed MODetector featuring dual light modulation and detection. With 10 dB extinction ratio and 0.8 dB insertion loss at the modulation state and 0.7 W/A responsivity at the detection state, this transceiver-like device (i) eliminates the OEO conversion, (ii) reduces optical losses from photodetectors via bypassing the photodetector when not needed, and (iii) enables cognitive routing strategies for network-on-chips. As such MODetector acts as a micrometer-compact transceiver for next-generation NoCs.

PRIMARY PRESENTER

Ruoyu Zhang

STATUS

Student — Graduate

AUTHORS

Ruoyu Zhang

Shuai Sun

Jiaxin Peng

Tarek El-Ghazawi

Volker Sorger

RESEARCH MENTOR/ DEPARTMENT CHAIR

Volker Sorger

ENGINEERING

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Energy-Efficient Scalable Multicore Architectures

Over the last decade, Moore's Law has slowed, while Dennard Scaling has ended. The end of voltage scaling has made power dissipation the fundamental barrier to scaling computing performance across all platforms—from hand-held, embedded systems, to laptops, to servers, to data centers. This challenge, often called the power wall, is seen across the board. To meet power challenges, recent research has proposed various low-power techniques. Power-gating, for example, is an effective technique that powers off the under-utilized components to reduce static power consumption. Dynamic voltage and frequency scaling (DVFS) is another technique that saves power by leveraging the application load to dynamically adjust voltage and frequency. The simultaneous use of various low-power techniques in one system can reduce more power consumption while creating several problems. For example, these low-power techniques can potentially conflict with each other if they are employed concurrently and make decisions at inappropriate times. These conflicts can even negatively affect performance and power savings.

In our research, we combine various power saving techniques while avoiding their shortcomings. The combination of different techniques leads to an explosion of design space. We further explore the use of machine learning to optimize the combined system.

PRIMARY PRESENTER

Hao Zheng

STATUS

Student – Graduate

AUTHOR

Hao Zheng

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ahmed Louri

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Effect of GLP-1 on Na+ Transport in Human Proximal Tubule Cells

GLP-1 (glucagon-like peptide) is a gut hormone that has been extensively studied. It has been found to have many functions such as lowering glucose, regulation of body weight, blood pressure, and lipid levels. Most notably, GLP-1 is known to be released from the activated L-cells when glucose is present and promotes insulin secretion. GLP-1 has especially been essential for patients with Type II diabetes as it increases renal excretion of electrolytes and helps with hyperfiltration. GLP-1 is expressed in the kidney and has been known to be present in proximal tubular cells and in the renal vasculature. However, studies have not extensively focused on GLP-1 effect on the renal proximal tubule. The proximal tubule is the site of active solute secretion, hormone production, and many of the metabolic functions of the kidney. One of its main roles is the maintenance of normal blood pressure through regulation of sodium transport. We hypothesized that the presence of GLP-1 decreases sodium transport in the human proximal tubules and has synergistic effects with D1-like dopamine receptors. To test our hypothesis we determined sodium transport in human renal proximal tubule cells by the changes of fluorescence emission of a sodium dye (Sodium Green). The cells were culture under polarized conditions in Transwells allowing to apply drugs in luminal and/or basolateral membrane. Preliminary results show that treatment with a GLP-1 agonist (Exendin 4; 10 nM) applied in the apical side decreased sodium transport similarly to the NHE3 inhibitor EIPA (200 nM), this effect was blocked in the presence of a GLP-1 antagonist (Exendin 3; 100 nM). Conversely sodium transport is increased in cells treated with a Glp1 agonist in the presence of a D1-like antagonist (1 μM) suggesting that D1-like receptors are involved in the effect of the Glp-1 on sodium transport. These preliminary results support our hypothesis; further experiments to determine GLP-1 role will be performed.

PRIMARY PRESENTER

Amanda Abraham

STATUS

Student – Undergraduate

AUTHORS

Amanda Abraham

Xioaxu Zheng

Pedro Jose

Ines Armando

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ines Armando

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Assessing the Gut Microbiota Response to Fecal Microbiota Transplantation in Children with Recurrent Clostridium Difficile Infection

Exposure to certain antibiotics disrupts the composition of a patient's gut microbiome, increasing susceptibility to recurrent Clostridium difficile infection (CDI). Fecal microbiota transplantation (FMT), a treatment for CDI, consists of transferring fecal material from a healthy donor to a patient's gastrointestinal tract to restore a healthy gut microbial diversity. Although there are numerous microbiome studies regarding the efficacy of FMT, there is a deficit in research regarding children with recurrent CDI. Therefore, to assess the bacterial composition of the gastrointestinal tract pre-FMT and observe compositional changes post-FMT, donor-patient pairs (n=9), with an average patient age of 10 years old, were established. For each pair, a single sample was collected from the donor and patient prior to transplantation, and after FMT, patient samples were collected longitudinally for up to five months. Samples were extracted using QIAamp DNA extraction kit and sequenced on a single Illumina HiSeq run, with an average of 8670338.25 reads per sample. Bioinformatic techniques were applied to characterize and compare the microbial composition between donors and patients. PathoScope was used to map metagenomic reads to the NCBI prokaryotic reference genome database for taxonomic classification. Differential abundance analysis and phylogenetic beta-diversity metrics were calculated in R. Our results show similarities to previous adult studies in that there are decreases in representatives of the phylum Proteobacteria and order Enterobacterales and increases in phyla Bacteriodetes and Firmicutes and orders Bacteriodales and Clostridales in patients after transplant. This is unexpected due to children having a dynamic developing microbiome, whereas adults have a relatively stable microbiome. Despite this similarity in microbiome composition, the children's dynamic state is evident in the fluctuating relative abundances for each phylum/order of bacteria in each time series sample. The use of adult donors in place of children may have impacted our results to resemble previous studies conducted on adult donor-patients.

PRIMARY PRESENTER

Michelle Ahn

STATUS

Student – Undergraduate

AUTHORS

Michelle Ahn

Keylie Gibson

Yuan Chen

Marcos Pérez-Losada

Keith Crandall

Suchitra Hourigan

Maria Oliva-Hemker

RESEARCH MENTOR/ DEPARTMENT CHAIR

Keith Crandall

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Overexpressions of Fatty Acid-Related Genes During Neurodevelopment in a FASD Model

Fetal Alcohol Spectrum Disorders (FASD), caused by prenatal alcohol exposure (PAE), is characterized by congenital central nervous system dysfunction resulting in impaired learning and motor skill deficits. FASD affects 2–5% of children in the U.S., with similar or higher rates reported worldwide. Subsequent single-cell RNA-sequencing in cortex of PAE mice showed variable gene expressions of individual neurons that persisted throughout life. Markedly, high expressions of fatty acid elongase 4 (ELOVL4) and fatty acid synthase (FASN), genes involved in fatty acid biosynthesis, were observed in a specific neuronal population in the PAE mouse cortex. FASN encodes a multi-enzyme protein involved in synthesis of palmitate into long-chain saturated fatty acids, and ELOVL4 encodes a membrane-bound protein involved in elongation of very long chain saturated and polyunsaturated fatty acids in the brain. Fatty acids are essential for regulating neuronal structure and function, and interferences in fatty acid metabolism are associated with neurodevelopmental disorders like autism and ADHD. Changes of fatty acid contents suggestively serve as peripheral biomarkers of FASD. However, functions of fatty acids synthesized by ELOVL4 and FASN remain unknown, and pathological mechanisms due to disturbed fatty acid contents in the brain are elusive. Our working hypothesis is that increase of these fatty acid-related gene expressions in the cerebral cortex is involved in the pathophysiology of FASD. To examine this hypothesis, we first tested if the increases of these genes occur at the protein level by performing immunohistochemistry. We further tested the pattern of increases; which types of neuronal cells and cortical regions show the increase, and which subcellular compartments show the increase of the expressions. In this presentation, based on the staining results, we will discuss how the expressions of fatty acid-related genes are altered due to the effects of PAE.

PRIMARY PRESENTER

Aiesha Basha

STATUS

Student — Undergraduate

AUTHOR

Aiesha Basha

RESEARCH MENTOR/ DEPARTMENT CHAIR

Kazue Hashimoto-Torii

HEALTH SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Early Apoptosis of Oligodendrocytes Increases Optic Nerve Inflammation in the EAE Mouse Model

The purpose of this study is to determine whether a double insult will lead to worse disease progression in animal models of multiple sclerosis, defined by increased immune cell infiltration in mice optic nerve. Using transgenic animals in which mature oligodendrocytes are selectively ablated through selected expression of an inducible activator of apoptosis, the first insult was ablation of oligodendrocytes during development. The second insult was EAE (experimental autoimmune encephalomyelitis), which is a relapsing-remitting model for multiple sclerosis that was induced in mature animals. The immune cells evaluated include: mast cells, natural killer cells, T cells, microglia, and ICAM-1, which is a ligand on leukocytes. Results were compared for double insult versus only 1 insult (CID or EAE) and between control and EAE animals. Preliminary results indicate that there is an increased number of immune cells in EAE optic nerve as opposed to naïve control optic nerves. Additionally, it appears that animals that were subjected to a double insult had increased numbers of immune cells in the optic nerve compared to those that received only a single insult (either developmental oligodendrocyte ablation or EAE). Further studies will determine the differences in microglial M1 and M2 polarization, B cell responses and astrocyte activation to characterize changes in the immune response following early oligodendrocyte ablation.

PRIMARY PRESENTER

Ranjit Bhangu

STATUS

Student – Undergraduate

AUTHORS

Ranjit Bhangu

Molly Karl

Leon Grayfer

Robert H. Miller

Ahdeah Pajoohesh-Ganji

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ahdeah Pajoohesh-Ganji

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

IL6 Expression During the Reconsolidation Window Following Fear-Conditioning and Reactivation of Pavlovian Fear Memory in Mice

In the current study, we investigated the expression of interleukin-6 (IL6) and it soluble receptor (sIL6R) during the reconsolidation window of fear memory in a mouse model of Post-Traumatic Stress Disorder (PTSD). Mice were first fear conditioned with five tone-shock pairings. 24 hours following fear conditioning mice were presented with a single tone to reactivate the fear memory. 2.5 or 24 hours following reactivation the mice were sacrificed and hippocampi and serum were extracted. Hippocampi were analyzed for IL6 and IL6R mRNA levels using quantitative PCR. Serum was analyzed for sIL6R levels using enzyme-linked immunosorbent assay. Centrally, there was a significant down regulation of IL6 mRNA following the end of the reconsolidation window, however no difference between IL6R mRNA inside and outside of the reconsolidation window in the fear conditioned mice ($p<0.05$, $p=0.79$). Peripherally, there was no difference between sIL6R levels measured inside and outside of the reconsolidation window in stressed mice ($p=0.13$). Overall, the results indicate physiological effects of the reactivation and reconsolidation of fear memories continue to occur following the end of the reconsolidation window. Research surrounding inflammation during the reactivation-extinction paradigm should not only focus on what physiologic variations are occurring during memory reconsolidation but following its end as well.

PRIMARY PRESENTER

Lily Clayton

STATUS

Student – Undergraduate

CO-PRESENTER

Adam Swiercz

AUTHORS

Lauren Clubb

Jessica Seidenberg

Zhe Yu

Adam Swiercz

Lily Clayton

Paul Marvar

RESEARCH MENTOR/ DEPARTMENT CHAIR

Paul Marvar

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Identification and Characterization of Novel D4 Dopamine Antagonists with High Affinity and Selectivity

Dopamine receptors belong to the G-protein coupled receptor (GPCR) superfamily and play an important role in the etiology and/or therapy of numerous disorders, and are thus a major focus of pharmacological research and drug discovery efforts. The dopamine receptor family consists of five members (D_1-D_5) that are differentiated on the basis of structure, signaling properties and tissue expression patterns. The D_4 dopamine receptor subtype (D_4R) is predominantly expressed in the prefrontal cortex where it plays an important role in cognition, attention, and executive function. Previous studies using D_4R ligands of varying efficacies have determined that D_4R signaling alters behavior in animal models of drug addiction and cognition. Developing novel D_4R-selective ligands will allow for detailed investigations into the biological roles of D_4R signaling in the brain and assist in medication development for related disorders. Due to high sequence homologies between the D_2-like (D_2R, D_3R, D_4R) receptors, however, the development of antagonists that selectively block the D_4R- has proven challenging. Less selective compounds often cross-react with other dopamine receptors, as well as other GPCRs, affecting non-D_4R-mediated signaling and potentially eliciting side effects. To identify a novel D4 antagonist with high potency and selectivity, we developed a series of lead compounds using computational analyses and medicinal chemistry approaches. Using radioligand binding competition assays, we identified one compound (CAB-01-019) with particularly high affinity and selectivity for the D_4R- (Ki for D_4R- = 2 nM vs. Ki for D_2R = 2900 nM, i.e., >1000 fold selective). We further characterized the pharmacological activity and selectivity of this lead compound by determining its ability to block dopamine-stimulated D_2R, D_3R, and D_4R-mediated β-arrestin recruitment. In addition, we examined the functional properties of CAB-01-019 using D_4R-mediated ERK phosphorylation, and cAMP accumulation assays. Using these carious approaches, CAB-01-019 was determined to be a functionally potent and highly selective antagonist for the D_4R. Schild regression analyses using CAB-01-019 antagonism of dopamine dose-response curves for stimulating β-arrestin recruitment or inhibiting cAMP accumulation revealed that CAB-01-019 interacts with the D_4R- receptor in a strictly competitive manner. CAB-01-019 thus represents a promising lead candidate for further optimization and development into a therapeutic for the treatment of disorders that are potentially responsive to D_4R antagonism.

PRIMARY PRESENTER

Aleksandra Dagunts

STATUS

Student – Undergraduate

AUTHORS

Aleksandra Dagunts

Benjamin Free

Marilyn Day

Comfort Boeting

Thomas Keck

David Sibley

RESEARCH MENTOR/ DEPARTMENT CHAIR

David Sibley

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Bromodomain and Extra-Terminal Domain Epigenetic Proteins as a Therapeutic Target for Metastatic Melanoma

Metastatic melanoma is the most aggressive skin cancer and is the sixth most common cancer, of all age groups in the USA. Introduction of BRAF inhibitors and cancer immunotherapy has greatly improved treatment of melanoma, however, the problem of tumour relapse and therapy resistance persists. So, a better understanding of the mechanism of development of the diseases is urgently needed to help devise an improved therapeutic intervention. Bromodomain and extra-terminal domain BET family is represented by three members in humans BRD2, BRD3, BRD4 and play key mediators of transcriptional activation. Specific BET inhibitors have been developed and are already in dose escalation clinical trials to investigate safety, tolerability and pharmacokinetics. Goal of this study is to identify the role of BET proteins in the melanoma cells. We, therefore examined the effect of BET pharmacological inhibitor JQ1 on the proliferation and survival of the three melanoma cell lines (A375, A375ma2 and WM164). Melanoma cells were grown and maintained in the RPMI media supplemented with 10% fetal bovine serum and 1% antibiotic mixture. 70-80% confluent melanoma cells were plated in 96-well plate overnight, then treated with JQ1 inhibitor. JQ1 was purchased from ChemieTek and 20mM stock solution was made in DMSO and stored at -20C until use. Melanoma cells were treated with various concentrations of JQ1 (1, 2.5, 5.0 and 10.0 uM) for 72-96 hours in the humidified 37C CO2 chamber. MTT 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium was added, followed by incubation at 37ºC for 4 hours. After addition of isopropanol containing 0.04N HCL, absorbance readings were taken at a wavelength of 570nm using spectrophotometer. MTT results showed a dose-dependent decrease in the cell proliferation in all the three melanoma cell lines tested, suggesting anti-proliferative role of BET inhibitor in the melanoma cells. In order to understand the role of BET inhibitors in the metastasis, we performed Invasion and migration assays in the melanoma cells. We used uncoated (for migration) and matrigel coated (for invasion) transwell assays to detect the migratory potential of A375, and WM793 cells, with or without JQ1 and IBET. Interestingly, both migration and invasion were found to be reduced in JQ treated cells relative to the control cells in all the cell lines examined. In summary our results suggest that BET proteins play an important role in the growth and progression of melanoma cells. Further studies are ongoing to delineate the mechanistic role of BRD proteins in the metastatic melanoma.

PRIMARY PRESENTER

Kamola Danier

STATUS

Student – Undergraduate

AUTHORS

Kamola Danier

Kang Le

Mamta Gupta

Ujwal Dahal

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mamta Gupta

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Community Partners Facilitate Access to Voice and Communication Services for Transgender and Gender-Diverse People

PRIMARY PRESENTER

Alyssa Giegerich

STATUS

Student – Graduate

CO-PRESENTERS

Kristen Davis

Sara Griffiths

AUTHORS

Alyssa Giegerich

Kristen Davis

Sara Griffiths

Adrienne Hancock

RESEARCH MENTOR/ DEPARTMENT CHAIR

Adrienne Hancock

BACKGROUND

Voice training for transgender and gender nonconforming individuals is in demand, yet is often inaccessible—especially for individuals of minority race or socioeconomic status.

To reduce the identified access barriers of cost, availability, and general knowledge of services, clinicians at the GW Speech and Hearing Center partnered with Whitman Walker Health to pilot a program to help people in the urban Washington DC area feminize their voice and communication.

METHOD

A 3-hour Saturday afternoon "Voice Feminization" workshop was held at a local safe-space for LGBTQ community members. Nine transgender women and gender non-conforming individuals (all assigned male at birth) learned and practiced adjusting their voice characteristics of pitch, resonance/quality, and intonation in small groups led by six graduate speech-language pathology clinicians and two licensed speech-language pathologists.

Outcome measures included changes (pre-workshop vs. post-workshop) in voice fundamental frequency (pitch), the most salient gender-marker of voice, and post-workshop participant ratings of their voice and the workshop program.

Each participant rated the following on a 5-point likert scale: overall workshop, structure of the workshop, content of the workshop, effectiveness of the training, pleasantness/helpfulness of staff, day and time of workshop, length of workshop, do you feel you made progress. Seven of the participants were available for follow-up via phone interview.

RESULTS

Speaking pitch (mean fundamental frequency) increased (i.e., feminized) after the workshop by a mean of 2.84ST (SD = 3.71ST, Range = 0.9--4.61ST). Changes in intonation, measured by F0 range during speech, varied by individual: 5 increased and 3 deceased their range. All participants felt they made progress during the workshop, rating progress as "very good" on the post-workshop survey (M = 4.11, SD = 1.05).

For program evaluation, all areas on the survey were rated as "good" (3) or better on the 1--5 scale. Participants viewed the overall workshop to be "very good" with a mean rating of 4.22 (SD=.67, n=9). Also with mean ratings of 4.22 were content of the workshop, effectiveness of training, and day/time of workshop. Category with highest mean rating (4.89) was pleasantness/helpfulness of staff. Comments indicating desire for a longer workshop were consistent with lowest mean ratings being for structure of the workshop (3.65) and length of workshop (3.22). Comments gathered from participants two weeks after the workshop via follow-up phone calls were consistent with post-workshop data. Generally, participants felt the need to practice their more feminized voice, particularly with a focus on resonance.

DISCUSSION

Due to the high ratings of the overall workshop, and quantitative improvement, it is recommended that similar workshops be created with time modifications to benefit the target population and their experience with voice feminization.

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

HIV-Infected Cells Have Depolarized Membrane Potentials and Increased Intracellular Calcium Levels

INTRODUCTION/BACKGROUND

Ion distribution between the extracellular, cytoplasmic, and organellar spaces creates membrane potentials which drive many of life's processes. This bioelectric membrane potential, driven by ion channel and pump activity, can be harnessed to allow or prevent entry of signaling mediators like Ca^{2+} into the cytoplasm. Several HIV proteins (Vpu, Env, Vpr, and Nef) have been reported to function as ion channels or alter ion channel activity. This activity likely influences cell fate including activation and apoptosis. *Hypothesis: HIV depolarizes the plasma membrane and alters intracellular calcium levels. Changing the polarization of the plasma membrane would alter the levels of HIV infection.*

METHODS

HIV infected cells were identified using a broadly neutralizing anti-Env antibody (PG9) conjugated to AlexaFluor-647. Membrane potential measurements were done by flow cytometry using the $DiBAC_4(3)$ dye as previously reported. Intracellular Ca^{2+} measurements were also done by flow cytometry using the Fluo-4 dye. Ionomycin and PMA were used to show the contrast in intracellular Ca^{2+} levels between infected and uninfected cells. To assess the effects of membrane potential changes on HIV replication, 200μM diazoxide was added to cells during infections.

RESULTS

HIV infected cells consistently had depolarized membrane potentials in both primary cells and cell lines. When cells were cultured with a depolarizing agent, diazoxide, there was an increase in HIV-infected cells. This membrane depolarization was accompanied by an increased resting level of intracellular Ca^{2+} in infected cells. Following addition of ionomycin, there was a drastic difference in Ca^{2+} flow between uninfected and HIV-infected cells. In uninfected cells, the addition of ionomycin induced an influx of Ca^{2+} while PMA had little effect. In contrast, both ionomycin and PMA induced a large efflux of Ca^{2+} from HIV infected cells.

PRIMARY PRESENTER

Ryan Goydos

STATUS

Student – Undergraduate

AUTHORS

Ryan Goydos

Robert Furler

Douglas Nixon

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Furler

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Comparison of /r/ Production in Children With Cochlear Implants and Children with Normal Hearing

For children with severe to profound prelingual hearing loss, the accessibility to sounds can be significantly diminished, resulting in deficits in both speech sound perception and production. The /r/ phoneme is a later acquired speech sound than most others and therefore is more likely to be effected by delayed access to sound resulting from hearing loss. The goals of the current study were to 1. examine /r/ production accuracy of prelingually deaf children with cochlear implants (CIs) and normal hearing (NH) children, 2. examine whether context of /r/ in the word had any added effect on accuracy of production, and 3. examine whether a child's hearing age (time since CI activation) had an effect on /r/ production accuracy. Ten /r/ containing words from the Bankson-Bernthal Test of Phonology (BBTOP) (Bankson & Bernthal, 1990) were obtained from 21 children with CIs (mean age = 62 months) and 20 NH children (mean age = 61 months). We used a mixed effects logistic regression to examine the effects of hearing status (fixed effect), individual abilities (random effect), and additional variables of age and phonetic context of the sounds (singletons or clusters). For all children, we found a positive relationship between accurate production of /r/ and children's hearing age. Within the group of children with CIs, both hearing age and phonetic context of the /r/ predicted accuracy of production ($p = .01$ and $p = .04$, respectively). Hearing age predicted differences in production between the two groups ($p = .02$). Both groups of children showed considerable variability in accuracy of /r/ production. The findings suggest that hearing age and phonetic context could be used to predict accuracy of /r/ production in both implanted and hearing children. A single factor that appeared to predict differences between the two groups of children was hearing age. Clinical implications of these findings will be discussed.

PRIMARY PRESENTER

Ellen Gurss

STATUS

Student – Graduate

AUTHORS

Ellen Gurss

James Mahshie

Cynthia Core

RESEARCH MENTOR/ DEPARTMENT CHAIR

James Mahshie

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Activation of the Forebrain Subfornical Organ Causes Hepatic Steatosis and Disrupts Liver Lipid Regulatory Pathways

Non-alcoholic fatty liver disease (NAFLD), characterized by an accumulation of hepatic triglycerides, is a significant contributor to chronic metabolic and cardiovascular disorders. We have recently demonstrated a role for the central nervous system in NAFLD. In particular, activation of a forebrain-hypothalamic circuit that involves excitatory projections from the subfornical organ to the paraventricular nucleus of the hypothalamus appears to play a key role. However, the underlying molecular mechanisms through which this neural circuit contributes to NAFLD remain unknown. We hypothesized that activation of excitatory SFO PVN-projecting neurons contributes to hepatic steatosis via influences on both liver acquisition and disposal pathways. To specifically activate SFO PVN-projecting neurons, we utilized a combinatorial viral approach in male C57Bl/6 mice. A retrograde transported adenovirus was targeted to the PVN to express Cre-recombinase in SFO PVN-projecting neurons (CAV2-Cre-GFP), combined with SFO microinjection of a Cre-inducible designer receptors engineered against designer drugs (DREADDs) viral construct (AAV2-DIO-hM3Gq-mCherry). Following surgical recovery, the pharmacological ligand clozapine-N-oxide (CNO; 3 mg/kg i.p.) was administered once daily over 6 days to activate SFO PVN-projecting neurons (n=4). Saline served as a control (n=3). Oil Red O staining demonstrated that 6-day activation of SFO PVN-projecting neurons resulted in the development of hepatic steatosis, whereas minimal liver lipids were present in control animals (2.69±0.02 vs. 2.92±0.02 au x 10^7, saline vs. CNO, $p<0.05$). In contrast, acute activation of this forebrain-hypothalamic network resulted in an elevation in hepatic carnitine palmitoyltransferase 1a, which is involved in mitochondrial β-oxidation (1.4±0.1 fold saline, $p<0.05$). Similarly, the free fatty acid transport protein cluster of differentiation 36 (2.3±0.6 fold saline, $p<0.05$) and fatty acid synthase (1.6±0.1 fold saline, $p<0.05$) were markedly upregulated following activation of SFO-PVN neurons, indicative of increased free fatty acid uptake into the liver and enhanced de novo lipogenesis, respectively. Collectively, these findings indicate that short-term activation of excitatory SFO PVN-projecting neurons results in hepatic steatosis, which is associated with potential alterations in liver lipid metabolic pathways including mitochondrial β-oxidation, de novo lipogenesis, and free fatty acid uptake.

PRIMARY PRESENTER

Claire J. Houchen

STATUS

Student – Undergraduate

AUTHORS

Claire J. Houchen

Katherine Blackmore

Hayk Simonyan

Colin Young

RESEARCH MENTOR/ DEPARTMENT CHAIR

Colin Young

HEALTH SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Starvation-Induced L1 Arrest Affects Fecundity of Subsequent Generations in the Entomopathogenic Nematode *Heterorhabditis Bacteriophora*

Arrested development is an important feature in the life cycle of nematodes, allowing survival for prolonged periods in adverse environments. Within parasitic and non-parasitic nematodes, an arrested third stage larvae (L3) is common in the life cycle, and may be facultative or obligate. In the free-living, model nematode *Caenorhabditis elegans*, a dormant first larval stage (L1) also develops in response to starvation. This L1 arrest has also been demonstrated in hookworms and the entomopathogenic nematode *Heterorhabditis bacteriophora*. While maintenance of an L1 arrest stage over evolutionary time in hookworm is necessary due to the harsh environments encountered by the free-living L1, dormant L1 are presumptively non-adaptive to *H. bacteriophora*. In contrast to *C. elegans* and hookworms, *H. bacteriophora* spends all but a single life cycle stage (the L3) within the highly nutritive environment of an insect host. Therefore, despite an apparent lack of need, L1 arrest remains conserved in *H. bacteriophora*, suggesting a potential function beyond ensuring survival under adverse conditions. To investigate this phenomenon, we characterized the effect of starvation and L1 arrest on fecundity of subsequent generations. *H. bacteriophora* embryos harvested from hermaphroditic adults were plated in the presence or 24-hour absence of their bacterial food source, *Photorhabdus luminescens*. Following re-feeding, the starved/re-fed and never starved L1 populations were observed, as were their offspring (F1) and the subsequent generation (F2), for any changes in fecundity, development, and fitness. The starved population demonstrated a 67% reduction in egg-laying, as well as a reduction in total F1 offspring produced compared to the control. Both trends continued in the subsequent F2 generation. While a reduction in F1 egg-laying was observed, the hatch rate for starved/re-fed nematodes was higher (44%). This suggests that starvation exerts long term, multigenerational effects on reproduction in *H. bacteriophora*. We also asked whether an extended period of starvation-induced L1 arrest associated with cryopreservation affected subsequent fecundity in recovered worms. A decrease in total life span and reproductive capacity of previously cryopreserved L1 versus controls was observed. Taken together, these results suggest that L1 arrest provides a method not only for surviving hard environmental conditions, but also for determining developmental and reproductive responses to environmental conditions.

PRIMARY PRESENTER

Zahra Iqbal

STATUS

Student – Undergraduate

AUTHORS

Zahra Iqbal

Kristin Mounts

Jonathan Vadnal

John Hawdon

RESEARCH MENTOR/ DEPARTMENT CHAIR

John Hawdon

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Implications for Culturally Competent Art Therapy for Native Hawaiians

OBJECTIVE

There is a deficit of research on Native Hawaiian mental health, Native Hawaiian perspectives on mental health stigma, and an even a greater absence of research on Native Hawaiians and art therapy. The purpose of this study is twofold: 1) identify guidelines for offering culturally competent art therapy for Native Hawaiians and 2) determine implications for how art therapy can counter negative attitudes toward seeking professional mental health services among Native Hawaiians.

METHOD

This qualitative action research study utilized expert interviews and a literature review. Three experts in Native Hawaiian health were interviewed: 1) a nurse and the CEO of a community health clinic in Hawaii, 2) a contemporary Hawaiian artist and educator, and 3) a psychologist, social worker and traditional health practitioner.

FINDINGS

Thematic analysis of the three in-depth interviews revealed three considerations: 1) Native Hawaiian ideas of health (i.e. seeking both western style medicine and *la'au lapa'au* or traditional Hawaiian medicine), 2) Native Hawaiian conceptions of art (i.e. art as a vehicle for healing, self-awareness and creating cultural identity), and 3) Native Hawaiian expectations and views of therapy (i.e. addressing emotional concerns within the family system or community).

IMPLICATIONS

This study proposed a program plan for culturally responsive art therapy for Native Hawaiians. It was found that a holistic approach of integrating Hawaiian language, family dynamics, genealogy, spirituality, traditional healing practices, and connection to nature along with western psychotherapy could be beneficial. This program plan could strengthen Native Hawaiian clients' cultural identity, and ground their mental health services in their culture and community. Therefore, providing culturally responsive art therapy could lessen the stigma toward mental illness and encourage Native Hawaiian clients to access professional mental health services.

PRIMARY PRESENTER

Lauren Kim

STATUS

Student – Graduate

AUTHOR

Lauren Kim

RESEARCH MENTOR/ DEPARTMENT CHAIR

Jordan Potash

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Effect of Metformin on Mesenchymal Stromal Cell Respiration

BACKGROUND

Metformin is an antihyperglycemic drug commonly used for type2 diabetic patients that inhibits mitochondrial respiratory chain complex-I. This drug has also been used as a targeted adjuvant cancer therapeutic; It inhibits the metabolic mTORC1 pathway linked to cell growth and proliferation. Use of metformin as adjuvant therapy exposes not only cancer cells but also surrounding normal cells (such as multipotent cells) to metformin. Metabolic function of stem cells is similarly linked to their growth and differentiation capacity However, the exact mechanism of action of metformin remains unknown. Thus, understanding metformin's mechanistic action and its impact on metabolic function and differentiation of stem cells is crucial to understanding the progression of disease post metformin therapy. This study aims to understand the impact of metformin on adipocyte-derived mesenchymal stromal cells' (MSCs) mitochondrial respiration and metabolic function.

METHOD

MSCs were cultured in absence and presence of 0.025mM and 0.25mM metformin for a maximum of 14 days and repeated three times. The 0.025mM metformin concentration reflects usual plasma concentration of metformin in subjects with diabetes. Cell proliferation, cell viability, mitochondrial cell function, and gene expression analysis were monitored.

RESULTS

Analysis of MSC's oxygen consumption showed possible concentration-dependent decreases in basal and maximal mitochondrial respiration between days 3-7. However, this effect was reversed on days 7-14 of metformin exposure when compared to the control. Analysis of cell viability demonstrated no significant differences but in some experiments cell proliferation rate was reduced by up to 31%. Gene expression analysis demonstrated potential effects on genes that control mitochondrial energetics such as PPAR-γ and PGC1-α, as well as the mitochondrial antioxidant gene SOD2. The effect of metformin on gene expression paralleled data on mitochondrial metabolic respiration obtained using a mitochondrial stress test. Genes PPAR-γ and PGC1-α were upregulated up to 1.75 fold and SOD2 was upregulated up to 2 fold at the end of 14 days of metformin culture, paralleling increases in mitochondrial respiration.

CONCLUSION

Exposure of MSCs to metformin demonstrated initial adverse mitochondrial respiration effects that were then compensated for by upregulation of mitochondrial genes such as PGC1-α and SOD2.

PRIMARY PRESENTER

Yana Kropotova

STATUS

Student – Undergraduate

AUTHORS

Yana Kropotova

Cleyton C. Domingues

Neeki Ahmadi

Michael Schmitt

Nabanita Kundu

Sabyasachi Sen

RESEARCH MENTOR/ DEPARTMENT CHAIR

Cleyton C. Domingues

HEALTH SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Experience of FARC Ex-Combatants in their Reincorporation Process, Through Art Therapy

OBJECTIVE

Psychosocial support programs are an intrinsic part of a sustainable and successful social reincorporation of ex-combatants in post-conflict situation. Following the end of Colombia's 50-year civil war, people who were formerly part of the Revolutionary Armed Forces of Colombia (FARC) are currently living in designated spaces for reincorporation into society. They are adjusting to a new way of living and redefining their community within the rule of law. As art therapy is an emerging field within the realm of mental health in Colombia, this project aimed to identify how the field can help advance existing initiatives of psychosocial support and reintegration.

METHOD

A qualitative, action-research case study explored the experience of this population with art therapy. Participants included families and individuals who self-referred or were recommended by communal leaders. Participants were provided an ample variety of art materials and invited to use found materials in a non-directive manner to allow maximum freedom of expression. Data consisted of participants' narratives and artwork, as well as researcher observations and field notes.

FINDINGS

Data analysis suggested four functions for art therapy: 1) facilitate communication among community members, 2) preserve memories of personal and historical relevance, 3) channel advocacy for policies of non-discrimination, and 4) artistic expression of beliefs and hopes. Participants expressed enthusiasm and curiosity in what art therapy could offer.

IMPLICATIONS

The findings outline a viable course of action for future art therapists by addressing psychosocial and reincorporation supports to individuals, families, communities, and society. Open dialogue with community members and on-site service providers is crucial to ensure art therapy that is both adaptive and responsive to changing needs.

PRIMARY PRESENTER

Luisa Mariño Garcia

STATUS

Student – Graduate

AUTHOR

Luisa Mariño Garcia

RESEARCH MENTOR/ DEPARTMENT CHAIR

Jordan Potash

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Obesity and the Immune System: A Systematic Summoning of Inflammation Factors

INTRODUCTION

Obesity is associated with a low-grade chronic inflammation that is linked to insulin resistance, cardiovascular diseases and type-2 diabetes. Obesity-induced inflammation is linked with abnormal production of pro- and anti-inflammatory cytokines such as TNF-alpha, INF-gamma, IL-6, and IL-4. Abnormalities in the expression of different receptors, ligands and adhesion molecules on PBMCs may lead to the development of different immunological diseases. TLRs are highly expressed on inflammatory monocytes (M1) as compared to anti-inflammatory monocytes (M2) which are reduced with increasing body mass index (BMI). It is not well defined how different cytokines trigger the inflammatory responses in the obese. We determined the differential changes in the immune response of the monocytic and lymphocytic fractions obtained from an obese subject as compared to a lean subject in response to TNF-alpha and IL-6.

METHODS

In this study, two participants were chosen based on their BMI; normal vs. obese. PBMC were separated through diluting blood with Phosphate Buffer Saline (PBS) containing Fetal Bovine Serum (FBS) (PBS with 2% of FBS). Then, Separation was done through histopaque density gradient, according to manufacturer's protocols. Cells were stained for CD3, CD4, IFN-gamma and IL-4 antibodies at 4°C in the dark for 30 minutes. They were then washed twice in cold BD cell wash buffer, fixed in 1% neutral buffered formalin and analyzed by flow cytometry. The levels of IFN gamma and IL-4 in cells supernatants were quantified using DUO set ELISA Kits according to the manufacturer's instructions.

RESULTS

FACS analysis on M1 cells showed an elevated expression of inflammatory of TLR-4 along with cytokine receptors in the obese individual. IFN-gamma and IL-6 levels were elevated in the obese individual in comparison to the normal individual, in both monocytes and lymphocytes. This was determined using ELISA-duo. TNF+IL-6 treatment lead to dramatic increase of INF-gamma in obese as compared to lean individual.

CONCLUSION

In this work it was shown that INF gamma levels were consistently high in samples taken from obese when compared to lean suggesting a possible chronic inflammatory states. When the monocytes and lymphocytes were challenged with TNF-alpha and IL-6 (to trigger inflammation), cells isolated from Obese individuals produced higher IL-4 levels compared to lean samples. Further investigation is required with larger N number as time and ethical approval limitations reduced the N number of this work.

PRIMARY PRESENTER

Sarah Murad

STATUS

Student – Undergraduate

AUTHORS

Mohammad Abdullah

Abdulaziz Alotaibi

Sarah Murad

Fatema Alrashed

Steve Shenouda

Rasheed Ahmad

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tara Scully

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Characteristics of Hidradenitis Suppurativa Patients with a Positive Family History

INTRODUCTION

Hidradenitis suppurativa (HS) is a chronic, recurrent, inflammatory disease of the apocrine sweat glands, characterized by recurrent abscessing inflammation. The disease affects approximately 1-4% of the population and there is currently no known cure. Family history of HS is seen in 40% of HS patients with some studies suggesting an autosomal dominant inheritance. The purpose of this study was to investigate the characteristics of HS patients with a positive family history.

METHODOLOGY

This research was conducted through the Wound Etiology and Healing Study (WE-HEAL Study), a biospecimen and data repository approved by The George Washington University IRB (041408). At the time of data lock, 86 patients with HS were included in this analysis. Data was analysed on age of diagnosis, disease duration, and time to diagnosis. HS disease activity scores used in this analysis included Hurley Stage, Hidradenitis Sartorius Score (HSS) and active nodule (AN) count.

RESULTS

Of the 86 patients with HS, 15 reported a family history of HS. There was no significant difference in age at enrollment or age at diagnosis in the patients with and without family history (p=0.563). The patients with a family history of HS had a longer mean disease duration (21.99 compared to 12.85 years, p=0.003). Patients with a family history of HS were also more likely to have Hurley stage III disease at the time of enrollment (p=0.024).

CONCLUSION

In this diverse cohort of HS patients in Washington DC a positive family history was seen in 17.4% of patients and was associated with a higher probability of Hurley stage III disease at enrollment.

PRIMARY PRESENTER

Elmer Rajah

STATUS

Student – Undergraduate

AUTHORS

Elmer Rajah

Sean McNish

Derek Jones

Victoria Shanmugam

RESEARCH MENTOR/ DEPARTMENT CHAIR

Victoria Shanmugam

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Validation of a Panel of microRNA Expression Signatures for Esophageal Cancer

Esophageal cancer (EC) is one of the deadliest form of cancers, with an extremely aggressive nature and poor survival rate. Biomarker signatures for EC could potentially improve cancer diagnosis and treatment. MicroRNAs (miRNAs) are small noncoding single-strand RNAs involved in post-transcriptional regulation of gene expression by binding to the 3′ untranslated region (3′-UTR) of their mRNA target. Accumulating evidence has demonstrated that miRNAs can have an important role as potential diagnostic biomarkers in various cancers including EC. By cross-referencing published miRNA signature data, we identified a list of dysregulated miRNAs in EC in which miR-203-3p, miR-205 and miR-375 are three most significant and frequently downregulated miRNAs in EC. The aim of this study was to validate this panel of miRNA signature in EC. We assessed the expression of these three miRNAs in EC cell lines, and primary EC tissues and their matched normal tissues by real-time reverse transcriptase-polymerase chain reaction (qRT-PCR). Expression of miR-203a-3p was low in adenocarcinoma EC cell lines, Flo-1 and JHU-Ad1 compared to squamous EC cell lines, KYSE-70 and KYSE-180. Low expression of miR-375 was detected in KYSE-70, KYSE-180 and adenocarcinoma cell line Flo-1 compared to normal esophageal squamous cell line, HET-1A except adenocarcinoma cell line JHU-Ad1. Furthermore, low expression of miR-203a-3p and miR-375 was detected in 89% (8 of 9) and 86% (12 of 14) esophageal squamous-cell carcinoma tissues compared to matched normal/dysplasia tissues. However, no significant expression difference of miR-205 was found in both cell lines and clinical EC tissues. These data suggest that miR-203a-3p and miR-375 may serve as biomarkers for EC early detection, with more clinical samples being analyzed to validate them. Further characterizing these miRNAs may elucidate their regulatory pathways in EC development.

PRIMARY PRESENTER

Shu Chang Ren

STATUS

Student – Undergraduate

AUTHOR

Shu Chang Ren

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sidney Fu

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

SPY Angiography Utility in Predicting Post-Mastectomy Reconstruction Complications

BACKGROUND

The use of intraoperative laser angiography (SPY) has been found to be beneficial for mastectomy patients in predicting complications such as necrosis. While the prevalence of SPY has been increasing, its impact on post-operative outcomes is not well described. We aim to investigate the results of SPY intraoperatively and how it affects post-mastectomy reconstruction outcomes.

MATERIALS AND METHODS

A retrospective analysis was performed from 2015–2017 from a single institution breast care center. Adult female patients were identified who underwent mastectomy with reconstruction. All patients underwent intraoperative SPY. SPY results were defined as good, questionable, bad, or had areas excised. Complications, defined as necrosis, infection, seroma, or explantation within 60 days of surgery were compared between SPY results. Univariate analyses were performed using fisher's exact test or ANOVA when appropriate. Pre-operative variables such as age, smoking, diabetes, and obesity were controlled for and entered into multivariable logistic regression models if the univariate test produced a p-value <0.1. A p-value <0.05 was considered statistically significant.

RESULTS

267 mastectomies were identified. 165 (62%) had good SPY results, 25 (9.4%) had questionable results, 25 (9.4%) had bad results, and 52 (19%) had areas identified that were excised. Patients with a questionable SPY result were significantly more likely to develop flap necrosis (p<0.01 OR 11 CI 95% 3.1-36), infection (p=0.02 OR: 6.3 CI 95% 1.3-31), or explantation (p<0.01 OR: 18 CI 95% 2.3-144) compared to patients with a good SPY result. Patients who had a bad SPY result were significantly more likely to develop a seroma (p<0.01 OR: 4.2 CI 95% 1.6-11) compared to patients with a good spy result. There were no significant differences between other SPY level groups. There were no mortalities within 60 days.

CONCLUSION

SPY angiography continues to be predictive of post-operative flap necrosis and other potential complications such as seromas. Patients with questionable or unclear SPY results are at higher risk for post-operative complications such as necrosis and infection than those with good or bad SPY results. This study suggests patients with indeterminate SPY results are likely underestimating the perfusion.

PRIMARY PRESENTER

Cecilia Rossi

STATUS

Student – Undergraduate

AUTHORS

Cecilia Rossi

Tammy Ju

Andrew Sparks

Anita McSwain

Joanne Lenert

Christine Teal

RESEARCH MENTOR/ DEPARTMENT CHAIR

Christine Teal

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Cardiopulmonary Resuscitation in the Pediatric Emergency Department: Initial Findings from the Videography in Pediatric Emergency Research (VIPER) Collaborative

BACKGROUND

Cardiopulmonary resuscitation (CPR) is frequently performed in a manner inconsistent with American Heart Association (AHA) guidelines. Published studies on CPR quality have reported data in aggregate form from entire CPR events. The addition of video review and the use of chest compression (CC) monitor devices allow precise measurement of CPR quality at the level of individual providers.

OBJECTIVE

To measure individual providers' CPR quality during actual pediatric cardiac arrests in the pediatric emergency department (PED).

DESIGN

A report from the Videography in Pediatric Emergency Resuscitation (VIPER) Collaborative, a prospective observational database from three tertiary PEDs.

METHODS

All study sites videorecord and review resuscitations. All events where CCs were performed under videorecorded conditions with the CC monitor device in use were eligible. Data on CPR performance was collected by a combination of video review and monitor device; CC rate and depth and ventilation rate were extracted in time periods corresponding to individual providers. CPR segments were defined as 'high-quality' if all AHA guidelines were achieved (CC rate 100–120 compressions per minute (cpm); CC depth >= 1.5 inches, infants or >= 2 inches, children; ventilation rate 8–12 breaths per minute (bpm), no pauses > 10 seconds).

RESULTS

Between August 2016 and November 2017, complete data was available for 11 events (infants=5; older children=6). 91 compression segments by 37 providers were analyzed. Median CC rate was 120 cpm (IQR 112–130); median depth was 1.1 inches, infants (IQR 1–1.7) and 1.4 inches, older children (IQR 1.2–1.8). Median ventilation rate was 12 bpm (IQR 9-15). 4/91 (4%) compression segments met all criteria for high-quality CPR.

CONCLUSIONS

Pediatric ED providers infrequently met AHA guidelines for high-quality CPR. Future studies using video review and CC monitor data collection should examine the impact of specific training strategies on provider-level CPR performance.

PRIMARY PRESENTER

Alexis Sandler

STATUS

Student – Undergraduate

AUTHORS

Alexis Sandler

Karen O'Connell

Matthew Ledda

Benjamin Kerrey

Sage Myers

Mary Frey

Aaron Donoghue

RESEARCH MENTOR/ DEPARTMENT CHAIR

Karen O'Connell

HEALTH SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

A Retrospective Comparison of Knee Ligamentous Reconstruction or Repair Follow-Up Compliance Between Patients Enrolled in Surgical Outcomes Systems and Patients Enrolled in a Traditional Follow-Up Protocol

The purpose of this study is to determine whether patients who underwent knee-ligament reconstruction or repair enrolled in Surgical Outcome Systems (SOS), a novel cloud based registry, demonstrated greater follow-up compliance than patients enrolled in a traditional follow-up protocol. Patients who responded and had not responded to a follow-up survey at least 3 months after their operation were identified and compared between the groups. Patients enrolled in SOS demonstrated a higher trend in percentage of follow-up (81.8% vs. 76.7; p = 0.4466), with greater benefit identified within patients who underwent multi-ligament knee reconstruction (85.7 vs 61.3 p = 0.2248). SOS demonstrates the potential to significantly increase follow-up compliance, especially in sub-groups of patients that classically has poor follow-up, with minimal limitations.

PRIMARY PRESENTER

Henry Shu

STATUS

Student – Undergraduate

AUTHORS

Henry Shu

Blake Bodendorfer

Christopher Folgueras

Evan Argintar

RESEARCH MENTOR/ DEPARTMENT CHAIR

Evan Argintar

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Improvement in Aortic Vascular Inflammation by PET/CT Associates with Improvement in Aortic Distensibility by PET-MRI at One-Year in Psoriasis

INTRODUCTION

Globally, 18 million people die from cardiovascular disease (CVD) annually, making it the leading cause of morbidity and mortality worldwide. In recent years, inflammation has been established as a key cause of CVD, but the effects of anti-inflammatory treatment on cardiovascular (CV) risk remains poorly understood. Psoriasis (PSO), a chronic inflammatory skin disease associated with increased CV events, provides an ideal clinical model to study inflammation and CV risk. Cardiovascular inflammation can be monitored by PET/CT of the aorta. Aortic distensibility (AD) is an important marker of subclinical CVD and has been shown to predict future CV events. Following subclinical markers, such as AD, enables physicians to make judicious treatment decisions before events such as stroke, myocardial infarction, or angina occur. Our study demonstrates a novel association between VI and AD in patients with chronic inflammatory disease.

HYPOTHESIS

A reduction in aortic vascular inflammation (VI), measured by PET/CT, will associate with increased AD, measured by PET-MRI at 1-year.

METHODS

Consecutively recruited PSO patients (N=50) underwent whole-body PET/CT scans to quantify VI as target-to-background ratio (TBR). Descending aorta contours on PET-MRI were traced throughout the cardiac cycle [Qflow, Medis] to measure AD. Longitudinal changes in aortic VI and AD were analyzed by multivariable regression.

RESULTS

The cohort was middle aged (mean ± SEM: 49.8 ±1.9 years), mostly male (56%), had low CVD risk, and mild-to-moderate PSO. At 1-year follow up, patients had a median improvement in PSO severity of 40% ($p<0.001$) with use of biological therapy (28/50 patients) while aortic VI decreased by 8% (1.81 ± 0.05 vs 1.67 ± 0.04, $p<0.001$) and AD increased by 10% (0.61 ± 0.03 vs 0.67 ± 0.04, $p=0.04$). Reduction in aortic VI was associated with an improvement in AD beyond traditional CV risk factors, statin use, and systemic/biologic PSO therapy ($\beta=-0.36$, $p=0.04$).

CONCLUSION

Improvement in aortic VI in patients with psoriasis by PET/CT is associated with improvement in AD by PET-MRI at 1-year, suggesting that treatment of inflammation may have a favorable impact on functional characteristics of the aorta. These findings further advance our understanding of the role of inflammation in CVD and the utility of PET-MRI for inflammatory CVD risk prediction. Our novel findings can help improve the accuracy of CVD risk prediction, enable physicians to make evidence-based decisions, and decrease the global economic burden of cardiovascular disease on healthcare systems.

PRIMARY PRESENTER

Parag Shukla

STATUS

Student – Undergraduate

AUTHORS

Parag Shukla

Amit Dey

Agastya Belur

Jacob Groenendyk

Youssef Elnabawi

Aditya Goyal

Justin Rodante

Leonard Genovese

Mark Ahlman

Martin Playford

Nehal Mehta

RESEARCH MENTOR/ DEPARTMENT CHAIR

Nehal Mehta

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Toward a Physiological Model of Consciousness: A Proposed Website and Study Design to Integrate Connectome-Based Data Repositories, EEG/Sleep Waveforms, and Network-Based Models of Consciousness

Several major efforts are underway to construct neurological connectomes that will model typical (and atypical) brain anatomy (i.e., neural circuitry) at various stages of human development. How consciousness emerges from the working brain is still under considerable debate. Stanislas Dehaene et. al. devised a method to observe (using EEGs) the difference in brain activity when a stimulus is perceived versus when it is not. As a result, they have identified at least four signatures of consciousness that aid in our ultimate goal to construct a physiological model of consciousness.

As consciousness may have a different meaning to different people, it is important to state an operational definition for it. Here, we operationally define consciousness as "the brain state of being awake; a state of awareness ranging from alert to drowsy, but not including the various stages of sleep, minimal consciousness, coma, or brain death." While there are many network-based models of consciousness (e.g., The information workspace model, the default mode network, the anticorrelated network, etc.), these functionally based models tend to ignore anatomical and other physiological constrictions (such as the inhibitory or excitatory nature of specific neurotransmitter cell types).

With our operational definition in mind, there are two purposes to this poster: 1) Create a data exchange format in order to automatically extract or exchange connectome data; and 2) Design an EEG-based study to determine the location of the neural circuitry involved in conscious activity.

PRIMARY PRESENTER

R. Franklin Smith

STATUS

Student – Graduate

AUTHORS

R. Franklin Smith

Omar Ramadan

Raja Mazumder

Andrea Gropman

RESEARCH MENTORS/ DEPARTMENT CHAIRS

Andrea Gropman

Omar Ramadan

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Systematic Pan-Cancer Analysis of Somatic Allele Frequency

Imbalanced expression of somatic alleles in cancer can suggest functional and selective features, and can therefore indicate possible driving potential of the underlying genetic variants. To explore the correlation between allele frequency of somatic variants, and total gene expression of their harboring gene, we used the unique data set of matched tumor and normal RNA and DNA sequencing data of 5523 distinct single nucleotide variants in 381 individuals across 10 cancer types obtained from The Cancer Genome Atlas (TCGA). We analyzed the purity-adjusted allele frequency in the context of the variant and gene functional features, and linked it with changes in the total gene expression. We documented higher allele frequency of somatic variants in cancer-implicated genes (Cancer Gene Census, CGC). Furthermore, somatic alleles bearing premature terminating variants (PTVs), when positioned in CGC genes, appeared to be less frequently degraded via nonsense-mediated mRNA decay, indicating possible favoring of truncated proteins by the tumor transcriptome. Among the genes with multiple PTVs with high allele frequency were key cancer genes including ARID1, TP53 and NSD1. Altogether, our analysis suggests that high allele frequency of tumor somatic variants can indicate driving functionality, and can serve to identify potential cancer-implicated genes.

PRIMARY PRESENTER

Liam Spurr

STATUS

Student – Undergraduate

AUTHORS

Liam Spurr

Muzi Li

Nawaf Alomran

Qianqian Zhang

Paula Restrepo

Mercedeh Movassagh

Christopher Trenkov

Nerissa Tunnessen

Tatiyana Apanasovich

Keith Crandall

Nathan Edwards

Anelia Horvath

RESEARCH MENTOR/ DEPARTMENT CHAIR

Anelia Horvath

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

HDAC6 and DNMT Inhibition Affect Immunogenicity of Ovarian Cancer Cells: A Rationale for Combining Epigenetic and Immune Therapy in Ovarian Cancer

BACKGROUND

Therapies that activate the immune system to fight cancer have shown robust responses in solid tumors. However, most patients, including those with ovarian cancer, do not respond to these therapies alone. Drugs that inhibit epigenetic modifying enzymes increase immune signaling from cancer cells. Epigenetic modifiers DNA methyltransferase inhibitors (DNMTi) and selective histone deacetylase inhibitors (HDACi), in particular selective HDAC6i, modulate immune-related pathways involved in anti-tumor immune responses. HDAC6i downregulate immunosuppressive ligands PD-L1 and PD-L2 by dephosphorylating pSTAT3 and upregulate tumor associated antigens (TAA) and antigen presentation machinery. Similarly, DNMTi activate anti-viral signaling via expression of Endogenous Retroviruses (ERVs) to trigger the type I interferon response, upregulate tumor antigen processing and presentation, and stimulate pro-inflammatory cytokines. The aim of our study is to test if the combination of epigenetic modulators Nexturastat A (Next A), a selective HDAC6i, and 5-azacytidine (AZA), a DNMTi, can be safely used to increase an immune response in ovarian cancer. We hypothesize that these drugs will enhance tumor immunity alone and when combined with immune checkpoint blockades targeting PD-1.

RESULTS

HDAC enzymes are differentially expressed in A2780, HEY, Kuramochi, SKOV3, and TykNu human ovarian cancer cell lines. HDAC1 and HDAC2 proteins were similarly expressed in HEY and SKOV3 whereas HDAC6 was expressed at lower levels in HEY and TykNu but at higher levels in SKOV3 and A2780. As previously reported, we believe this is due to the presence of the chromatin modifier ARID1A mutation in the SKOV3 and A2780 cell lines. The upregulation of HDAC6 also correlated with a higher IC50 for Next A treatment in those particular cell lines. Further immunoblots showed that PD-L1 protein, a marker of poor prognosis in ovarian cancer, decreased after treatment with Next A and even more in combination with AZA in Hey, SKOV3, and TYKNu cell lines. PCR analysis demonstrates that combination therapy also induces a type 1 interferon response on all cell lines and alters the expression of markers that modulate the tumor-immune reaction. Additionally, DNMT1, the known target of AZA, was decreased after treatment with AZA and NextA, both independently and in combination, a finding that has not been previously reported.

CONCLUSIONS

As shown previously, HDAC6 enzyme levels are higher in cell lines with ARID1A mutations. DNMT1 was decreased after treatment with AZA, as expected, but surprisingly also after treatment with Next A. PD-L1 decreased after treatment with Next A and even more so when combined with AZA. We thus believe that combining these two epigenetic modifiers will lead to an additive effect on immune signaling through stimulation of antiviral signaling (DNMTi), which can upregulate the immunosuppressive ligand PD-L1, which is then reduced by HDAC6 inhibition. We are currently testing the combination of both epigenetic modifiers with anti-PD-1 in an immunocompetent mouse model of ovarian cancer.

PRIMARY PRESENTER

Aneil Srivastava

STATUS

Student – Undergraduate

AUTHORS

Aneil Srivastava

Sara Moufarrij

Melissa Hadley

Erica Palmer

Stephanie Gomez

Sarah Chisholm

Micael Lopez-Acevedo

Alejandro Villagra

Katherine Chiappinelli

RESEARCH MENTOR/ DEPARTMENT CHAIR

Katherine Chiappinelli

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Looking Back at the Epidemic: A Retrospective Study of HIV in Washington, D.C.

Washington, D.C. consistently has one of the highest annual infection rates of HIV in the United States. Although HIV is well-studied in many urban areas, Washington, D.C. has largely been overlooked, despite being the nation's capital and a large, international city. To date, only three papers have been published that analyze prospective HIV sequence data from this area. To address how HIV is currently evolving and spreading in Washington, D.C., and better recognize how it will in the future, we must first understand how it did so in the past. To this aim, we conducted a retrospective study of 3,500 HIV sequences from the D.C. area collected from three separate datasets within the last ten years. Our analysis focused specifically on the pol gene, which contains drug resistance mutations, and a variety of phenotypic associations (sex, risk factor, race/ethnicity, viral load, HIV subtype, and anti-retroviral regimen type). Using both maximum likelihood (RAxML) and Bayesian inference (MrBayes and BEAST) based phylogenetic methods, we found that there are a variety of subtypes circulating within DC (94% B, 2% C, and 0.3% D). A total of 57 transmission clusters between the three datasets were found as well, showing that combining similar datasets provides a more robust representation of the HIV epidemic in the DC area. This also suggests that there are areas within the DC area that need additional awareness and prevention efforts. Given the maturity of the HIV epidemic in DC and that HIV has an extremely high mutation rate, there is a possibility that these transmission clusters have formed in previously unknown high-risk groups within the city. The results of this study will be combined with results from prospective studies in order to aid HIV prevention efforts in Washington, D.C.

PRIMARY PRESENTER

Margaret Steiner

STATUS

Student – Undergraduate

AUTHORS

Margaret Steiner

Keylie Gibson

Marcos Perez-Losada

Keith Crandall

RESEARCH MENTOR/ DEPARTMENT CHAIR

Keith Crandall

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Increase in Damage Caused by Systemic Lupus Erythematosus (SLE) in African American Women As Opposed to Non-African American Women

INTRODUCTION

Systematic Lupus Erythematosus (SLE) is an autoimmune disease that can affect the joints, skin, kidneys, heart, brain, lungs, and blood cells. The disease affects approximately 1.5 million Americans, and 90% of those affected are female. Recent studies have shown that African American women are more likely to have SLE than any other demographic. The purpose of this study was to investigate demographics and disease activity parameters of lupus patients enrolled in the GW Lupus Study.

METHODOLOGY

This research was conducted through the GW Lupus Study, a biospecimen and data repository approved by The George Washington University (IRB 031614). All subjects gave written informed consent for longitudinal collection of their data while they receive treatment according to standard of care. At the time of data lock, 26 patients had data available for inclusion in this analysis. Data was collected on baseline demographics, as well as disease activity scores including the physician reported SLEDAI (SLE Disease Activity Index) and the patient reported SLAQ (Systematic Lupus Activity Questionnaire). Lupus disease damage was recorded using SLICC (Systemic Lupus International Cooperating Clinics) scoring. Data was analyzed using GraphPad Prism (version 5.0).

RESULTS

In this longitudinal cohort of lupus patients, 96.15% of patients were female, and 53.85% of patients were African American. Disease damage as measured by the SLICC was significantly higher in African American women (2.07 ± 2.24 compared to 0.33 ±0.89; p=0.0187). By contrast, disease activity (SLEDAI and SLAQ scores) demonstrated no statistical difference in these two populations. Respective scores for African American versus non-African Americans were SLEDAI: 2.00 ± 2.57 compared to 2.75 ± 5.05 (p=0.289) and SLAQ: 7.07 ± 7.91 compared to 3.36 ± 4.70 (p=0.183). Baseline level of education was not a confounding factor when comparing disease activity and damage.

CONCLUSION

In the GW Lupus study, African American women demonstrate significantly higher SLICC scores compared to non-African American women, suggesting higher rates of disease related damage in this population. Ongoing longitudinal follow-up of this cohort is planned.

PRIMARY PRESENTER

Sarah Stupp

STATUS

Student – Undergraduate

AUTHORS

Sarah Stupp

Sean McNish

Derek Jones

Victoria Shanmugam

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sean McNish

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Nucleolar Access is Variable in Leukocytes Depending on Cellular Adhesion & Migration

INTRODUCTION

The nucleolus within eukaryotic nuclei is formed from ribosomal DNA (rDNA) regions of acrocentric chromosomes 13, 14, 15, 21 and 22 in humans. In addition to ribosome biogenesis, the nucleolus has been shown to be important in mRNA splicing, DNA damage responses, and RNA metabolism. Nucleoli provide a link between transcription and translation, making them critical for protein expression. Viruses can alter nucleolar function by targeting viral proteins to this structure. HIV-1 early-expressed proteins Tat and Rev both have highly basic nucleolar localization signals (NoLS) which may cause HIV-induced alterations of mRNA splicing, cytoplasmic transport, and translation. HIV-1 effects showed differences in nucleolar availability by highly-basic NoLS-containing peptides within adherent versus migrating leukocytes. This may suggest HIV-1 Tat and Rev only localize to the nucleolus when the infected cell is adherent.

METHODS

To investigate chemotactic versus adherent behavior of leukocytes, primary human peripheral blood mononuclear cells (PBMC) were cultured on fibronectin-coated microscope dishes with 20IU/mL IL-2 in serum-containing RPMI for 4-7 days prior to imaging on a Zeiss Confocal microscope. Nucleolar presence in both adherent and chemotactic leukocytes was confirmed using brightfield timelapse imaging on an incubated stage for variable times. Nucleolar accessibility of adherent versus chemotactic cells was assessed using a deca-arginine peptide conjugated to FITC. R10-FITC has previously been shown to localize to the nucleolus. Nucleolar structure of PBMC was done using transmission electron microscopy (TEM) using heavy metal staining. Live cell confocal and TEM was done at the GW NIC.

RESULTS

Under brightfield microscopy, large prominent nucleoli could be seen in both adherent and chemotactic leukocytes. Despite clear presence of nucleoli in both cell types, only nucleoli from adherent cells were labelled with the R10-FITC, suggesting differences in the accessibility of the nucleoli in chemotactic cells.

DISCUSSION

NoLS-containing peptides are highly basic and their positive charges have shown to bind to the high amount of negatively charged RNA within the nucleoli. The inability of R10-FITC to localize to the nucleoli of chemotactic cells suggests decreased presence of rRNA and ribosome biogenesis within the nucleolus. Changes in nucleolar activity between migrating and adherent leukocytes may be directly linked to ribosome number and protein production within these states. Viral interference of nucleolar availability through HIV-1 Tat and Rev proteins may not only change mRNA splicing and protein translation in the infected cell, but also may change the ability of the cell to migrate or adhere to its environment.

PRIMARY PRESENTER

Karol Suchowiecki

STATUS

Student – Undergraduate

CO-PRESENTER

Wyatt Nice

AUTHORS

Karol Suchowiecki

Wyatt Nice

Robert Furler

Douglas F. Nixon

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Furler

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Longitudinal Follow-Up of Patients with Scleroderma Sine Scleroderma

INTRODUCTION

Scleroderma is an autoimmune disease characterized by inflammation, vasculopathy, and fibrosis. Scleroderma Sine Scleroderma is a subtype of scleroderma in which there is autoantibody positivity as well as internal organ involvement without skin involvement. The purpose of this study was to investigate longitudinal outcomes in a cohort of patients with scleroderma sine scleroderma.

METHODOLOGY

This research was conducted via the STOP Scleroderma Study, a biospecimen and data repository approved by The George Washington University IRB (051427). All subjects gave written informed consent for longitudinal collection of their data. Of the 66 scleroderma patients enrolled in the STOP scleroderma study at the time of data lock, 17 fulfilled criteria for scleroderma sine scleroderma. Data was collected on baseline demographics, and longitudinal measures of disease activity were collected at each clinical visit including the modified Rodnan skin score and the Medsger severity score. Data was analyzed using GraphPad Prism (version 5.0).

RESULTS

Organ involvement was seen in 4 of the 17 patients who had sine scleroderma at enrollment with a mean follow up of 5.90 ± 4.65 years. There was no significant difference in age between patients with (54.13 ± 13.26 years) and without organ involvement (41.19 ± 2.84 years, p=0.138). Of the patients who developed organ involvement, 50.00% were African Americans and 50.00% Caucasians. There was no significant difference in race between patients with complications and without complications (p=0.272). Internal organ involvement included pulmonary (11.76%), GI tract (5.88%), cutaneous (5.88%), and vascular (11.76%) complications.

CONCLUSION

In this cohort of patients with scleroderma sine scleroderma, only 23.53% of patients developed internal organ involvement during follow-up indicating scleroderma sine scleroderma generally carries a good prognosis. Ongoing longitudinal follow up of this cohort is planned.

PRIMARY PRESENTER

Steven Thomas

STATUS

Student – Undergraduate

AUTHORS

Steven Thomas

Sean McNish

Derek Jones

Victoria Shanmugam

RESEARCH MENTOR/ DEPARTMENT CHAIR

Victoria Shanmugam

HEALTH SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Characterization of the Histological and Molecular Properties Conferred by the Addition of Guanidine Thiocyanate to a Buffered Alcohol-Based Fixative

For the past century, formalin has remained the most commonly used and widely accepted tissue fixative for preserving both histological and molecular characteristics of cells. However, as the field of biomolecular science continues to develop and grow, the need for a fixative that offers improved biomolecular integrity increases. Though neutral buffered formalin, which contains 10% formalin, provides exceptional histology due to the cross-linkage of proteins that preserves cellular architecture, its mechanism of action also leads to the degradation of protein, DNA, and RNA content present in the tissue. Previous research has established that buffered ethanol 70% offers improved DNA, RNA, and protein quantity and quality as compared to NBF. As recent research has well-characterized the histological and molecular properties of BE70, this study focused on how these properties are modified or changed by the addition of guanidine thiocyanate to the solution. Guanidine is often used in RNA and protein extraction due to its chemical propensity to bind to and denature protein. The BE70G fixative demonstrated higher quantities of RNA and DNA, and increased quality of DNA. Additionally, though protein yield was not increased between each of the fixatives, a marked difference was observed in the protein quality of BE70G. Immunohistochemical and H&E staining indicated BE70G provides poor nuclear detail and definition of cellular architecture. Overall, data suggests that guanidine thiocyanate confers improved biomolecular integrity to BE70, but much is left to be desired in its histological properties. Further studies are needed to replicate quantity and quality data, as well as characterize the histomorphological features of the addition of guanidine.

PRIMARY PRESENTER

Katharine E. Walker-Bawa

STATUS

Student – Undergraduate

AUTHOR

Katharine E. Walker-Bawa

RESEARCH MENTOR/ DEPARTMENT CHAIR

Stephen Hewitt

HEALTH SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Defining the Roles of Amphibian (*Xenopus Laevis*) Macrophages During Immune Challenge with the *Batrachichytrium Dendrobatidis* Chytrid Fungus

Amphibians are experiencing an alarming global decline, with chytridiomycosis, a disease caused by pathogenic fungi, *Batrachichytrium dendrobatidis* (*Bd*) being a central contributor to these declines. Macrophages (Mϕs) are one of the first immune cells that would encounter these invading fungal cells and presumably eliminate this threat through phagocytosis of *Bd*. In turn, colony stimulating factor-1 (CSF-1) is the principal Mϕ growth factor that is indispensable to macrophage survival, proliferation and differentiation. CSF-1 binds to the CSF-1 receptor (CSF-1R), expressed on committed macrophage-lineage precursors and derivative populations. Recently, interleukine-34 (IL-34) has been identified as an alternate CSF-1R ligand and in the amphibian *Xenopus laevis*, this cytokine gives rise to morphologically and functionally distinct Mϕs to those derived by CSF-1. The objective of this study was to investigate the immune interface between CSF-1- and IL-34-derived Mϕs and *Bd*. Here we show that *Bd* exposure increases the CSF-1- and IL-34-Mϕ gene expression of the immunosuppressive cytokine, interleukine-10 (IL-10) and CSF-1-Mϕ expression of the arginase-1 (Arg-1) enzyme. *Bd* exposure also increases the IL-34-Mϕ gene expression of indoleamine 2,3 dioxygenase (IDO) enzyme, which is known to play a role in suppression of T cells. We also demonstrated that *Bd* exposure modulates the expression of several hallmark Mϕ genes such as pro-inflammatory cytokines, immunosuppressive cytokines and their cognate receptors as well as antimicrobial enzymes. Together, this work defines the mechanisms by which *Bd* confers immunosuppression in both CSF-1- and IL-34-derived Mϕs.

PRIMARY PRESENTER

Amulya Yaparla

STATUS

Student – Graduate

AUTHORS

Amulya Yaparla

Leon Grayfer

RESEARCH MENTOR/ DEPARTMENT CHAIR

Leon Grayfer

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Access and Barriers to Gender-Affirming Voice and Communication Services: A Focus on the Communities Multiply Marginalized

BACKGROUND

Not all people who want to change their voice to be more consistent with their gender presentation have access to professional training from a speech-language pathologist. A national survey is used in this study to identify access barriers beyond classification in a gender- minority group, such as race and socio-economic status. Individuals marginalized on multiple accounts may experience the greatest disparities in access to this important part of treatment for gender dysphoria.

METHOD

Following focus group development, the survey was reviewed by content experts and finalized. The survey addressed demographics, gender identity, understanding of voice and communication services by a speech-language pathologist (VCS-SLP), desire for services, and affordability. Snowball sampling was employed via the Internet by sending a recruitment message with a link to the survey. LGBTQIA+ community centers, advocacy groups, chat forums, listservs, and professional colleagues across all 50 states were contacted. Paper surveys were mailed upon request. Of 138 responses, 74 met inclusion criteria (i.e., reside in the US, identify as a gender different than the sex they were assigned at birth, and be at least 18 years old) and were sufficiently completed. Of those, 39 respondents identified their race as Caucasian only (white), while 35 identified as being at least one non-Caucasian race (POC).

RESULTS

Disparities existed in reported income and the ability to afford VCS-SLP between white and POC respondents. 51% of the POC group reported annual incomes below $40,000 (29% below $10,000) as compared to 36% of the white group (8% below $10,000). The number of POC respondents stating they did not believe they could afford VCS-SLP was 12% higher than white respondents. Of the POC respondents who had never participated in VCS-SLP, 40% stated not being able to afford it as the reason, as compared to 10% within the white group. The white group was more informed about VCS-SLP, with 14% more of those respondents either having prior knowledge of or experience with VCS-SLP than the POC group.

DISCUSSION

Barriers of cost and lack of knowledge of VCS-SLP disproportionally affect gender diverse people of color and with lower income, as compared to their counterparts. Education about VCS-SLP in communities of color as well as reduced-cost options for services would be reasonable avenues to explore in attempts to improve access to VCS-SLP for gender diverse populations.

PRIMARY PRESENTER

Dara Yazdani

STATUS

Student – Graduate

AUTHORS

Dara Yazdani

Sierra Downs

Alyssa Giegerich

Kristen Davis

Emily Chessher

Michael Ferguson

Julia Donovan

Adrienne Hancock

RESEARCH MENTOR/ DEPARTMENT CHAIR

Adrienne Hancock

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Reactivation of HIV with HDAC Inhibitors and Resultant HERV Expression

HIV is a retrovirus which continues to plague the world, and a widespread cure remains elusive. Remarkably, a new way of attacking HIV may be through mobilization of human endogenous retroviruses that populate all of our genomes, which is the focus of my current research.

It is estimated that approximately 36.7 million people were living with HIV. At the end of 2016, 1.8 million people were newly infected globally with 54% and 43% of children and adults respectively were receiving lifelong antiretroviral therapy (ART). Cure strategies have been ineffective due to the ability of HIV to evade complete elimination while remaining transcriptionally silent during its latency phase. Additionally, HIV readily evades direct targeting by mutation of its viral envelope, thus escaping the antibody response. Even during ART, it appears a portion of infected cells cannot be effectively reactivated and targeted for elimination. For these reasons, there is a need for novel reactivating and targeting mechanisms to effectively eliminate HIV from infected individuals.

Of particular interest in targeting HIV for elimination are human endogenous retroviruses (HERVs). HERVs are ancient retroviral infections have been integrated into the human germ line. The majority of these elements remain transcriptionally silent due to inactivation by mutation and methylation. However, more recently integrated HERVs can express virus like transcripts and proteins, which have been identified in human embryonic development, viral infections, autoimmune diseases, and cancer. Furthermore, HERVs may serve as potential biomarkers. This would allow for the indirect targeting of infected cells. With no direct targeting, HIV's evasion by mutation would be avoided.

A continually evolving class of drugs, known commonly as Histone Deacetylase Inhibitors (HDACi) are of great interest in reactivating latent HIV. HDACi were originally used to treat a variety of cancers, but have more recently been employed in the reactivation of cells latently infected with HIV-1 to move toward eradicating the persistent viral reservoir. Due to their direct effect on the acetylation level of histones and their role in transcriptional activation. The current hypothesis is that certain HERVs may be upregulated after treatment of HIV infected cells with different HDACi. My current research relies on cell lines that mimic HIV latency, treating these with varying HDACi, and observing reactivation levels in addition to the different HERVs that could be upregulated, which would allow for subsequent targeting of HIV positive cells in an attempt to better target and eradiate the virus.

PRIMARY PRESENTER

Paul Zdinak

STATUS

Student – Undergraduate

AUTHORS

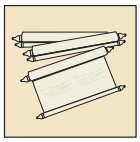
Paul Zdinak

Miguel de Mulder

Douglas Nixon

RESEARCH MENTOR/ DEPARTMENT CHAIR

Douglas Nixon



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Wrath and Woe of Heroes: Translating Male Grief in Homer's Iliad

Homer's *Iliad* has always held a fascination for me in the drama of its central heroes, particularly when it comes to Achilles. The original Greek text holds little back in its depictions of its heroes; Achilles wails as he rips off his clothes and in other moments of heroic redemption drags a body around the city. While there are obvious displays of masculinity within the *Iliad*, what is often overlooked is a softness and emotional intelligence with which the Ancient Greek portrays these men. My research has been not only locating and examining these moments of purposeful change, but also finding the reason for why they have come to be.

In studying translations of Homer's *Iliad*, I have found what appears to be a tendency to not only subvert the emotional responses of men, but to masculinize them, especially when it comes to displays of grief. This study pulls from literary theory fields of both translation studies as well as affect theory to examine how translators have interpreted Homer's original Greek to fit their contemporary standards. My research focuses on three translations of this text: Alexander Pope's 1715 edition, Samuel Butler's 1898 edition, and Caroline Alexander's 2015 edition. Pope takes on the challenge of this translation by updating the text into a metered verse in English, while Butler takes a more standard approach in keeping his translation in prose. However, I found it necessary to include Alexander's approach, in that her translation provides us the lens of both a contemporary translator and a woman. From these three translations, I have been able to evaluate how translations of this text have changed within a 300 year period, and how these translations represent the cultures of masculinity from which they were created.

PRIMARY PRESENTER

Margot E. Alpert

STATUS

Student – Undergraduate

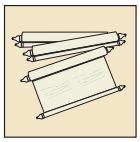
AUTHOR

Margot E. Alpert

RESEARCH MENTOR/ DEPARTMENT CHAIR

Daniel Dewispelare

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Principals' Experiences with SEL Implementation

Research has shown that Socio-Emotional Learning (SEL) programs have succeeded in bringing about positive outcomes in the overall growth and development of children in the U.S. As a result, many educators across the country are moving to integrate SEL programs into their curriculums. In response to this national trend, former DCPS Chancellor Wilson has made SEL an integral part of his strategic plan for the next five years (A Capital Commitment). At the same time, research suggests that principals are responsible for spearheading these initiatives, and that their leadership during periods of organizational change can widely affect the outcome of such initiatives. Thus, it is critical to understand how D.C. principals are responding to the push for SEL initiatives in their schools. Principals' perspectives can provide nuanced accounts that can promote improved practice. The purpose of this study is to gain insight into the experiences of DCPS principals as they respond to forces promoting the implementation of SEL in the District. In order to do this, the present study seeks to interview up to 15 principals in order to share their experiences regarding this important matter.

PRIMARY PRESENTER

Valentina Barrera Vasco

STATUS

Student – Undergraduate

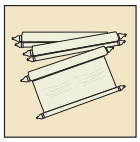
AUTHOR

Valentina Barrera Vasco

RESEARCH MENTOR/ DEPARTMENT CHAIR

Linda Byington

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Rulers Reimagined: Arguments for Minoan Female Rule on Bronze-Age Crete

The Minoan civilization existed as a theocratic society arising to significant power around the 20th century BCE and succumbing to external control around the 15th century BCE. The Minoans were given their name by one of their earliest excavators, Sir Arthur Evans. Upon excavating a labyrinth of rooms at the site of Knossos on the island of Crete, Evans, rather inaccurately and problematically, named the civilization after King Minos, known from the Greek myth *Theseus and the Minotaur*. This early action set into motion an androcentric trend in interpretation that has resulted in most scholarship arguing for male dominance of Minoan Crete.

The object of this analysis is to call into question such androcentric claims and to establish the possibility that women could have ruled. Since there is no written evidence for either male or female rule in contemporary texts, iconography depicting individuals in positions of power, specifically 1) individuals in seated positions and 2) individuals with animals, were analyzed. These two categories are considered major cross cultural and cross temporal motifs that depict rule. The relevant iconography is found on sealstones, wall paintings, and rings from known sites on Crete dating from before 1450 BCE. Many of the images were specifically chosen to address a previous tendency to identify the women depicted in them as goddesses or priestesses, rather than as rulers. Additional comparisons are made to various civilizations, that are known to have been ruled by women, in order to address the frequent claim that women could not rule in a male-controlled Mediterranean.

Results from the analysis establish that iconography depicting possible female rulers does exist, while male rulership cannot be established. Additionally, it is clear through analogy to various other periods and locations that women could, and did, rule in male-dominated societies. Individual female rulers from contemporaneous societies, such as Hatshepsut of Egypt and Shibtu of Mari, clearly indicate that, at the time of the Minoans, female rule was known and accepted in the Eastern Mediterranean.

Since further in-depth analysis of Minoan archaeology would be needed to make solid claims about women's power and their position in an Aegean hierarchy during the Bronze Age, all that can be said for now is that there is a potential for female rule. At the very least, what this analysis establishes is that a reassessment of archaeological interpretation must be done through both androcentric and gynocentric lenses.

PRIMARY PRESENTER

William Berkery

STATUS

Student – Undergraduate

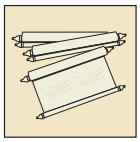
AUTHOR

William Berkery

RESEARCH MENTOR/ DEPARTMENT CHAIR

Eric Cline

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

United Front: A Case Study of Coalition Warfare on the Marne at the Close of World War I

On July 15th, 1918, the German Imperial Army rushed Allied troops, who were defending the Marne River, in hopes of ending the Great War. The Allies, however, were prepared for the second meeting on this battlefield in four years. The army defending the river, with the capital of Paris only a few miles to their back, was composed of French, American, and British troops who had finally united after four years of discombobulated resistance. These combined forces under Marshal Ferdinand Foch defeated the Germans at the Second Battle of the Marne and quickly pushed their adversaries back to the French border to force a surrender by November 11, 1918.

Why was Foch's Army so successful, whereas four years of warfare had resulted in bloody stalemate after stalemate? The object of this study is to analyze the effectiveness of coalition warfare, and the efficacy of allied forces fighting together versus individually. While many historians claim that American intervention in the Great War was the deciding factor for victory, other sources argue that American troops needed French assistance as much as the French needed American reinforcements. Through historical secondary sources, and primary documentation such as war department statistics, after-action reports, and first-hand soldier accounts, this study claims that a symbiotic relationship, which sprouted when both armies came together under a single leader, propelled the Allies to victory.

By looking at this sequence of battles, as well as a glimpse into the political leadership of the Allied nations, it is clear that coordinated allied forces had and could have the capacity to achieve quick victory. Fragile diplomatic relations can prove a difficult barrier to work through, as was the case in the Great War, but strong central leadership yields progressive results. Under such leadership, information, resources, and tactics shared between factions better prepare the whole for combat. Foch's coalition army is the prime example of success in modern warfare, and set the standard for future generals to follow.

PRIMARY PRESENTER

Keegan Caulfield

STATUS

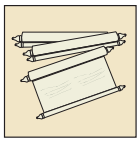
Student – Undergraduate

AUTHOR

Keegan Caulfield

RESEARCH MENTOR/ DEPARTMENT CHAIR

C. Thomas Long



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Historic East Los Angeles: A Catalyst for Social Change and Community Empowerment

In 1939, a Home Owner's Loan Corporation assessment of East Los Angeles repugnantly proclaimed the neighborhood "a 'melting pot'... honeycombed with diverse and subversive racial elements." These neighborhoods defined as "subversive" by the dominant white-owned institutions of the 1930s have not only been shelters for the city's racial, ethnic, and religious minorities, but have helped shape some of the most enduring multicultural communities and powerful social movements of the twentieth century.

My research explores how marginalized communities in East Los Angeles throughout their history have created movements for social change and empowerment. Specifically, my research asks "What factors enabled East L.A. to become one of the most powerful incubators of social movements in American history?" By examining primary source documents including photographs, personal narratives and maps as well as secondary source historical materials, my findings identify the historical factors in East L.A. that led to the formation of powerful social movements for liberation and equality that changed the American social landscape.

My research consists of three case studies that highlight marginalized ethnic communities in East L.A., the first of which examines how East L.A.'s Jewish community in the early 20th century became a national center for resisting anti-Semitism. Local Jewish inhabitants in turn formed coalitions with their Japanese-American and Chicanx neighbors to resist popular and institutionalized racism. The second case study addresses Japanese-American East Angelenos and their resistance to discrimination in access to health care, as well as their collective response to the devastating effects of Japanese Internment during World War II. This legacy of community empowerment continued as the American Chicanx rights movement grew out of the activist organizations of East L.A. in the 1960s and 1970s, as outlined in my third case study.

My findings conclude that the unique history of East Los Angeles provides insights into the social conditions that produce liberation movements powerful enough to bring about social change on a national and international scale. The history of East L.A. suggests that the urban factors producing powerful social movements are: 1) neighborhood density, 2) a concentration of marginalized racial/ethnic groups with common experiences of institutional racism, 3) strong neighborhood institutions (i.e. businesses, religious institutions, community-based self-help organizations), 4) multiethnic/multiracial cooperation, and 5) space for artistic and cultural expression. Understanding how these conditions lead to effective social movements sheds light on how marginalized communities can transform the urban spaces that they occupy into sites of empowerment.

PRIMARY PRESENTER

Carley Christerson

STATUS

Student – Undergraduate

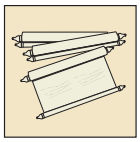
AUTHOR

Carley Christerson

RESEARCH MENTOR/ DEPARTMENT CHAIR

Christopher Klemek

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

“Baby You Light Up My World Like Nobody Else”: Analyzing Cultural Authenticity, Gender Bias, and Adolescent Development through One Direction and their Fans

In 2010, Harry Styles, Zayn Malik, Niall Horan, Liam Payne, and Louis Tomlinson individually auditioned for one of the UK’s most popular talent-search television shows, *The X-Factor*. The boys were grouped together during the show’s run, and while they placed third in the finale, their success after the show skyrocketed. They headlined four tours, sold over 70 million records, and won sixteen Billboard music awards. One Direction was one of the most successful bands in the post-rock era, yet mainstream music and arts publications suggest they are culturally inauthentic, superficial, and a marketing ploy rather than a legitimate artistic endeavor. My project challenges these assumptions, arguing instead that One Direction is culturally, and academically, relevant and influential. By analyzing the relationship adolescent girl fans have with the band, or as fan studies scholar Henry Jenkins says, “how fans are using media texts and what new meanings they [are] creating,” this essay strives to showcase how One Direction plays a meaningful role in both personal and communal development. Contrasting this evidence with examples of cultural critiques of One Direction, this essay also analyzes how a devaluation of girls’ experiences and biases against girls in fandoms contribute to ideas about One Direction’s inauthenticity. By privileging the perspective of the girl fans, this essay focuses on legitimizing girls’ personal development, and continuing the scholarship on fan relationships through a contemporary example.

PRIMARY PRESENTER

Michelle Cohn

STATUS

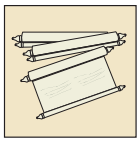
Student – Undergraduate

AUTHOR

Michelle Cohn

RESEARCH MENTOR/ DEPARTMENT CHAIR

Gayle Wald



ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Through Her Eyes: Baya Mahieddine and The Female Form in French Algeria

The art historical canon of modernism is ever expanding to include those twentieth-century artists and oeuvres that had once been considered less seminal and influential than the predominantly white, male, and European artists who continue to dominate museum walls and art history textbooks. As the art history community's understanding of global modernism widens and deepens, there is no better time to grow the body of scholarship on Algerian Surrealist, Baya Mahieddine.

From Paul Gauguin to Ernst Ludwig Kirchner, male European avant-garde artists are celebrated for their sexualized depictions of exotic female forms. If the women and girls they objectified held the brush, what would they paint? The life and oeuvre of Baya embody the answer. Although she was not the subject of orientalist or primitivist painting, Baya was relegated by the canon of modernism in a similarly demeaning way. My research is motivated by my belief that, if this dynamic changes, Baya's story could become a critical contribution to the strong, extant feminist critique of sexism in the canons of primitivist, expressionist, and surrealist art.

My research focuses on Baya's multifaceted artistic and historical identity: as a subject of French colonial rule, as an Amazigh in Algeria, as a woman, and as an outsider to art history. Practically speaking, my research is grounded in visual analysis and is supplemented by close-readings of primary sources, including exhibition catalogues and magazine articles on Baya's art from her lifetime. Additionally, my research pulls heavily from relevant secondary scholarship in both French and English.

This research approach is strengthened by a choice to specifically analyze Baya's later-career works, from the 1960s onwards. This choice aims to broaden existing, scholarly visual analyses of her works which, at the present time, are focused heavily on her early-career works. While these in-depth studies of her 1940s-era works help to make space for Baya in the art historical conversation, my emphasis on Baya's later artistic production widens this space while also working to erase her lasting label as a child-like, naive prodigy. Baya is frozen in time as the teenage prodigal discovery of the European Surrealist community, but studying her later works will help to solidify her as a mature contributor to the global Surrealist body of art.

PRIMARY PRESENTER

Quinn Divens

STATUS

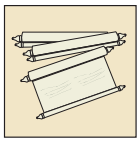
Student – Undergraduate

AUTHOR

Quinn Divens

RESEARCH MENTOR/ DEPARTMENT CHAIR

Bibiana Obler



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Block 8: The Untold Story of the Residents of Meridian Hill Before the Park

In June 1910, Congress approved the condemnation of Blocks 8, 17, and 23 of the Meridian Hill subdivision "for the purpose of providing a reservation of a public park." Within two years, the 33 wood frame dwellings on Block 8 had been demolished, and construction began shortly after on a grand, neoclassical park in the heart of Northwest DC.

The history of Meridian Hill Park has generally concentrated on its role in the positive development of the 16th Street neighborhood and the local elites who lobbied for it. Records document, however, a substantial community of freed slaves living on Meridian Hill dating back to the end of the Civil War. To this point, comprehensive research has yet to be completed to understand the nature of the residents of the Meridian Hill neighborhood before the federal government acquired the land.

This essay seeks to fill this gap by tracing the residents of one of the condemned blocks through the United States Census. The communal portrait that emerges from this analysis raises the question of how a public park came to be built where an established community of working class African Americans were living. The research presented here suggests that the combination of urban idealism, private interest, and federal involvement led to the displacement of this community. Ultimately a close study of Block 8 provides insight into layers of marginalization experienced by African Americans during the McMillan Plan, one of the most impactful periods of Capital development.

PRIMARY PRESENTER

Lydia Francis

STATUS

Student – Undergraduate

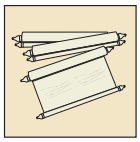
AUTHOR

Lydia Francis

RESEARCH MENTOR/ DEPARTMENT CHAIR

Katrin Schultheiss

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Explanatory Role of Mechanisms in Providing Successful Medical Treatment

How much must be known about a disease, the human body, and the relationships between the two in order to treat that disease successfully? One of the major debates in the philosophy of biology is centered on the understanding of scientific processes and how those processes can be explained when they occur across different levels in the body. This poster will argue that the best way to provide a medical explanation that will lead to successful treatment is through the use of a mechanistic model. This will be presented through two examples, the first of which is an example that emphasizes the importance of mechanisms in developing new and successful treatments for cancer. The second example tells the of about how failing to understand the mechanism of biointeraction for the drug Thalidomide led to dangerous consequences. This poster will then present the most fitting mechanistic theory to provide an adequate medical explanation. This theory has been developed by Carl Craver, and though he did not intend it to be used as a medical explanation it provides the necessary scaffolding for a sufficient medical explanation that is likely to lead to more successful treatments.

PRIMARY PRESENTER

Alexandra Geoca

STATUS

Student – Undergraduate

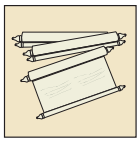
AUTHOR

Alexandra Geoca

RESEARCH MENTOR/ DEPARTMENT CHAIR

Eric Saidel

HUMANITIES



ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Technology's Drag on Inflation in the EU-28

Trends in the rate of inflation following the Great Recession in the United States and the European Union remain a mystery. While the rate of unemployment has returned to its natural rate for the countries of the European Union and the United States, the growth in the change in prices of goods and services received by producers in both economies has remained stagnant. With this research, I observe trends in the post-recession producer prices in the past decade. I find that producer price inflation has also experienced slack in its growth. I attribute the lack of growth to the growing role of high-technology products as inputs for producers. By observing changes to the prices of technology using the European Union's symmetric input-output tables, I conclude that the lowering cost of technology has trimmed 0.2 percentage points, or 20 basis points, per year from production costs and ultimately from final prices. Without these tech inputs, annualized inflation would be slightly higher.

PRIMARY PRESENTER

Joaquin Piczon Goquiolay

STATUS

Student – Undergraduate

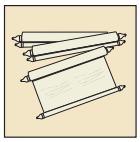
AUTHOR

Joaquin Piczon Goquiolay

RESEARCH MENTOR/ DEPARTMENT CHAIR

John Volpe

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Spectacle of Empire: The Flavian Amphitheater In Martial's *Liber Spectaculorum*

The Flavian Amphitheater, colloquially known as the Colosseum, opened in 81 CE under the rule of the Flavian emperor Titus. The Colosseum has been known since its opening for its spectacular gladiatorial fights, animal fights, and beast hunts. The structure, however, represented much more than glorified and romanticized public entertainment. I argue that it was constructed and interpreted as a manifestation of the empire. The 1st century Roman epigrammatist Martial documents the inaugural games in the *Liber Spectaculorum*, a corpus containing 36 poems on the spectacles. His poems discuss the amphitheater as a physical structure, gathering place for the community, venue for public spectacles, and glory of the Roman civilization. His playful and cheeky epigrams hold important clues to daily Roman culture and society. While analyzing the epigrams, I was struck by the inseparable link between the amphitheater and the empire. I have hypothesized that the amphitheater is a manifestation of the empire and represents its expanse, authority, and community. In order to test this thesis I focused primarily on Martial's *Liber Spectaculorum*, consulting an array of other sources to supplement Martial: Pliny the Younger, and Suetonius; Flavian architectural, artistic, and numismatic evidence; and secondary sources by historians, philologists, literary theorists, and archaeologists. I have found that the amphitheater indeed connects the community with the empire and more importantly, with the emperor. Using my own translation and analysis of the epigrams, I determined that the amphitheater fostered cohesion for the community through shared experiences, represented the geographic expanse of the empire though the array of peoples in the audience and animals in the arena, and reinforced the emperor's authority through his control over nature, life, and death. In relating the spectacles to the benevolence and power of the emperor, Martial stresses the interconnectedness between the empire and the amphitheater. My work takes into account the social and ideological aspects of the amphitheater as represented by Martial and connects each feature to a facet of Roman empire, showing that the more nuanced and comprehensive understanding of the Flavian Amphitheater is one that bonds the structure with the empire.

PRIMARY PRESENTER

Harper Hansen

STATUS

Student – Undergraduate

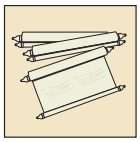
AUTHOR

Harper Hansen

RESEARCH MENTOR/ DEPARTMENT CHAIR

Katherine Wasdin

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Exploring the Impact of Negative Partisan Affect on Logical Reasoning

Voters are regularly called upon to reason logically about the merits of politicians, parties, and policies. Logical reasoning plays an important role in citizens' political decision making. However, the growing trend of partisanship, and the negative feelings that go along with it, might be threatening this logical competency. Understanding the effects of this growing trend of partisanship is particularly important to the functioning of America's political system. A strong answer has not yet been provided to the question: how does partisanship, specifically partisan affect, impact individuals' ability to think clearly and reasonably? More specifically, do increased levels of negative partisan affect (NPA) impede logical reasoning ability? This paper hypothesizes that increased levels of NPA will negatively impact logical reasoning ability. In a survey experiment, 1,075 participants solved logical reasoning tasks after completing either a neutral or NPA-inducing free write task. Participants who received the NPA (experimental) treatment did not perform statistically worse than individuals who received the neutral (control) treatment. As a next step, the survey will be repeated using an alternate method of emotional induction.

PRIMARY PRESENTER

Steven Kelly

STATUS

Student – Undergraduate

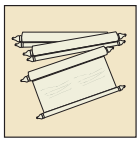
AUTHOR

Steven Kelly

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ethan Porter

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Faith and Secular Morality in Iris Murdoch's *The Time of The Angels* (1966)

"Could there be a good religious way of life without supernatural beliefs?" Iris Murdoch poses this question to her readers in her philosophic treatise, *The Sovereignty of Good* (1970). Can individuals be moral citizens without relying on the idea of God? Murdoch's theories into the nature of morality and rationality were fitting for her historical moment: postwar Britain haunted by the trauma of the Blitz and facing the Cold War threat of nuclear annihilation. In her tenth novel, *The Time of the Angels* (1966), Murdoch explores the idea of institutionalized religion within a quasi-dystopian world. Carel Fisher, the rector of a bombed-out Christopher Wren-designed church in late 1940s London, suffers from spiritual doubts. His anxiety is manifested in a strange kind of agoraphobia, where he forces himself and his small family to live in isolation. Marcus Fisher, Carel's younger brother, a philosopher and academic, is writing a treatise on the benefits of atheism. Through the spiritual and emotional dilemmas of the Fisher brothers, Murdoch examines the nature of postwar disillusionment with organized religion. One of the key characters in the novel is Eugene Peshkov, a Russian refugee who is Carel's handyman. Much of the action of the novel centers around Peshkov's family heirloom, a centuries-old Russian icon. Murdoch admired the works of Leo Tolstoy and Anton Chekhov, and her interweaving of Russian characters and themes within her novel enables her to compare both English and Russian cultural attitudes towards religion and art within a Cold War setting. In this paper, I hope to explore how Iris Murdoch contends with ontological and ethical themes within the capacious artform of the novel. Is mysticism a necessary prerequisite for the cultivation of moral imperatives? Did Britain's diminished place within a postwar geopolitical order contribute to a gradual erosion of faith within the Anglican Church, or to the reevaluation of a new kind of belief-system?

PRIMARY PRESENTER

Farisa Khalid

STATUS

Student – Graduate

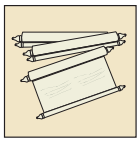
AUTHOR

Farisa Khalid

RESEARCH MENTOR/ DEPARTMENT CHAIR

Margaret Soltan

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Visual Journey of a Refugee: A Case Study

OBJECTIVE

Art therapy can provide an opportunity to present personal narratives with consideration to cultural standards of expression. Through the tools of image and narrative presented through art therapy, it is possible to capture a glimpse of the experience of a refugee.

METHOD

A qualitative case study explored the experience of a group of siblings in a metropolitan area. Over two sessions, they used images and words to share their unique experience of the refugee journey through the use of a visual journal. Participants were provided with semi-structured prompts and a wide array of art materials which included fluid materials such as paint and oil pastels to restrictive materials of colored pencils and markers. The freedom in both art materials and directives allowed for a range of responses.

FINDINGS

Participants were able to share their journey to the United States and acclimation to their new society. Visual journals included themes of spontaneous disclosure of trauma, spirituality as a source of resiliency, cultural family dynamics, as well as acculturation process.

Acculturation was affirmed in the blend of Syrian icons as well as American holiday symbols. The values of a collectivist culture emerged as strengths that allowed for orientation towards the future.

IMPLICATIONS

This case study demonstrated the utility of art therapy for refugees to share their experiences in a culturally responsive manner. The participants displayed a range of disclosure through creative expression and the containment of a visual journal. Art therapy can reduce cultural stigma around seeking therapeutic services within the refugee population. The shortage of refugee accounts using a trauma informed approach demonstrates the increased need for additional research and direct therapeutic services such as art therapy.

PRIMARY PRESENTER

Iman Khatib

STATUS

Student – Graduate

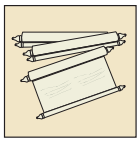
AUTHOR

Iman Khatib

RESEARCH MENTOR/ DEPARTMENT CHAIR

Jordan Potash

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Finding a Home: The Plight of Jewish Women After World War II

The horrors of the Holocaust and the anti-Semitism that surrounded and permeated its place in history, have been told most strikingly through the memoirs of those who survived it. Whether the author escaped into hiding before deportation, was the resident of a ghetto, or was a prisoner of the concentration camps, each person who survived was able to tell their stories and continue with their lives, however difficult the recovery and adjustment was. But how did these survivors of the most extreme period of anti-Semitism deal with the thought of returning to their home countries after the war had ended? Were they to simply to go back and pick up where they left off before the war? Did they even want to return, and if not, where did they go? Choosing to focus primarily on Jewish women and girls in this situation, my research examines the many factors that influenced their decisions to go back to, or leave, their home countries after the war. Using memoirs written by female survivors, interviews, and a memoir written by a male survivor who wrote at length about his mother's experiences, this research discerns several key parameters with which to analyze the survivors' post-war decisions. These parameters are age during the war; religiosity before and after the war; education before the war; the physical status of survivors' previous homes after the war; the severity of the challenges they endured during the war; and the status of close family members after the war. Based on these parameters, it is determined that while all of these factors undoubtedly played a part, these survivors' decisions to either live in their home countries or emigrate elsewhere were largely determined by the latter two parameters: the status of their family, and the severity of the challenges they had faced. For the female survivors in this study, and undoubtedly others, their own experiences, as well as their families', experiences were the main causes of emigration or resettlement after the war.

PRIMARY PRESENTER

Veronica La Du

STATUS

Student — Undergraduate

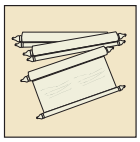
AUTHOR

Veronica La Du

RESEARCH MENTOR/ DEPARTMENT CHAIR

Arie Dubnov

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

‘Little White Men’: The Transformation of The Southwest and the Remaking of the American Colonial Frontier at Bent’s Fort

Located on the Arkansas River in present-day southeastern Colorado, Bent’s Fort once functioned as the heart of the massive economic system of the Great Pains, pumping furs, supplies, people, and cultures from the Front Range into the low central Plains and out into American, Canadian, and European markets. The establishment attracted individuals from the Arapaho, Cheyenne, and Pawnee nations, where they exchanged furs, gifts, and even wedding vows at a rate that surpassed any other establishment of the same nature or period. Reaching its commercial peak during the 1830s and 40s, Bent’s Fort and its diverse team of actors marked a pivotal moment in colonialism in North America, when European influences began retreating from the central Rocky region as a young United States transitioned from a semi-traditional model of settler colonialism to more aggressive methods of colonization contingent upon militarism, geopolitical manipulation, and resource extraction.

My research builds upon previous studies of the nature of international trade, particularly of furs, in the region and how it influenced—and was influenced by—the dynamics of ritualism, respect, race, and power. My research also tackles the concept of credit extension. This is a concept that figures largely into the broader history of the North American fur trade, yet has remained unexplored in this field. Understanding how these exchanges and their consequences altered Native and non-Native peoples deeply impacts how scholars and students of North American history understand American colonialism and the major economic, cultural, and environmental changes that occurred on the Great Plains during the nineteenth century.

My research is interdisciplinary by nature; imperialism, colonialism, and capitalism function as the fibers that wove Native American interests, objectives, and fates in with those of European, Mexican, and, most significant to my research, American individuals, institutions, and governments. Because the histories of Native America, the United States, and North American colonialism are inextricably concomitant, I incorporate a variety of primary sources into my research, including (but not limited to): private diaries of military personnel and independent traders, recorded oral histories and traditions, trade receipts, military records, territorial and federal policies, and private correspondence. Secondary literature from the fields of Native American, western American, borderlands, colonial, environmental, and economic history has influenced my research approach and is likely to influence my conclusions.

PRIMARY PRESENTER

Annabel Labrecque

STATUS

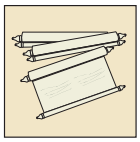
Student – Undergraduate

AUTHOR

Annabel LaBrecque

RESEARCH MENTOR/ DEPARTMENT CHAIR

David Silverman



CORCORAN SCHOOL OF THE ARTS & DESIGN

New Methods: Alternative Art Spaces in the Contemporary Era

The term "alternative art space" stems from a history of DIY, punk galleries in the 80s, which were operated by artists with the purpose of revolting against the bureaucratic limitations of typical museum structures. Throughout history, alternative spaces push the boundaries of who can operate and curate art spaces, and where and how art can be experienced. This research project questions the role of contemporary alternative spaces and how they can be defined within current contexts; the hypothesis of the study stated that contemporary spaces are rebellious and built from a foundation of institutional critique. To investigate this topic, I conducted interviews with artists in 25 alternative arts spaces in Washington, DC, Baltimore, New York, and Los Angeles in a variety of locations—shipping containers, rooftops, even cars that had been transformed into art environments. In each interview I discussed several topics to understand the composition of current alternative arts spaces, being: how the gallery started, the initial motivation behind the space, and what makes alternative art spaces different from traditional galleries now.

Several common factors emerged from the research: 64% of the alternative spaces included in the study are operated by an individual artist; 80% of individuals interviewed hold a master's level of arts education; 40% are located in a personal or residential space, the remainder are in repurposed spaces such as a warehouses and retail space; and 72% of alternative spaces interviewed don't operate financially or hold formal organization. Overall the factual results of the study reveal that alternative spaces are usually operated by highly educated artists, without any formal structure and all are in unusual spaces. Aside from the factual makeup of alternative spaces, the motivating factors behind them is nuanced and varied. The conversations with artists disclosed that my initial hypothesis was incorrect: most alternative spaces aren't built from a rebellious standpoint, but rather from a search for a space without any ties to historical art exhibiting rules and limitations. Additionally, current alternative spaces aren't concerned with the definition and actions of historical ones, instead generally reacting to specific needs and circumstances of individual art communities. Rather than derivative of and rebellious to standing gallery structures and norms, alternative spaces seek to invent and investigate new methods of showing and experiencing art through experimentation with organization, location, and critical thought.

PRIMARY PRESENTER

Maeve McCool

STATUS

Student – Undergraduate

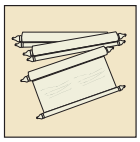
AUTHOR

Maeve McCool

RESEARCH MENTOR/ DEPARTMENT CHAIR

Lisa Lipinski

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

A Critical Examination of East Germany's Stasi in History and Memory

The Ministry for State Security (MfS) functioned as the Sword and Shield of East Germany's Socialist Unity Party from its creation in 1950 to its final dissolution in 1990 with the collapse of the German Democratic Republic. Colloquially known as the Stasi, the MfS became one of the most extensive political police apparatuses in world history, imprisoning about 11,000 people. This project exclusively focused on their main remand prison, Berlin-Hohenschönhausen, and seeks to examine how the trauma inflicted in these prisons continues to have a legacy in Germany today. My research supplements traditional scholarly work by looking at documentaries in tandem with interviews and primary documents to produce a nuanced and multi-faceted analysis of East German political repression and its long-term consequences. I spent three weeks in Berlin in July interviewing former political prisoners, touring Berlin-Hohenschönhausen multiple times, and doing research with scholarly and primary documents in the library of the Agency of the Federal Commissioner for the Stasi Records. Thus far the data that I have collected demonstrates that the effects of the psychological interrogations that were conducted in Berlin-Hohenschönhausen have continued to have an immense impact on former prisoners years after the reunification of Germany. The data has also showed that through working as tour guides, many former inmates have felt that they can recapture a level of agency that the Stasi took from them during their imprisonment, and help them continue to cope with the trauma of their past. Analysis of my data is still ongoing, and further results will most likely reveal even more significance in the how the mental trauma of imprisonment still permeates these former inmates' everyday lives. This project and preliminary findings are integral to understanding Germany's most recent dictatorship, and how the legacy of trauma can persist within historical memory.

PRIMARY PRESENTER

Margaret McCool

STATUS

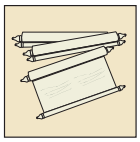
Student – Undergraduate

AUTHOR

Margaret McCool

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mary Beth Stein



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Replacement of God and Huxley's "Religious Emotion"

Aldous Huxley wrote extensively about the role of religion throughout his life, and explored many different religions, but always remained true to one belief about Christianity: the religion's practices replace true worship of God. It is this research's aim to analyze Huxley's comments on Christianity, and demonstrate how his critiques of the religion manifest themselves in *Brave New World*. In "The Substitutes for Religion," Huxley writes that the "fundamental religious state of mind" is "a sense of awe in the face of the mysteries and immensities in this world "¦ rationalized in the form of belief in supernatural beings" (Huxley 250). However, the danger with connecting to the "fundamental religious state of mind" is that the emotion can become the object of worship, and not "god himself" ("The Substitutes for Religion" 250). This "hysterical" emotional appeals in the religion are a key criticism Huxley expresses about Christianity ("Religious Practices" 350). Using the definition of the "fundamental religious state of mind" and a literary analysis of two of his essays on religion, including "The Substitutes for Religion" (1927) and "Religious Practices" (1937) as a lens to view the events in the novel, the research finds two primary ways that Huxley believed Christianity evokes the "religious emotion." These are: belief in a personal God, and ritual. Each of them correspond, respectively, with two dystopian aspects in the society of Brave New World that also stimulate this "religious emotion" for the citizens that partake in them: Fordism, and the soma use in the Solidarity Service. Therefore, Brave New World makes a parody of Christianity by containing dystopic practices that clearly parallel with Christian ones: each dystopic practice resembles its Christian counterpart on the surface, but also unites its participant to his or her "fundamental religious state of mind". For Huxley, in both the novel and Christianity, God is replaced with the "religious emotion."

PRIMARY PRESENTER

Olivia Morris

STATUS

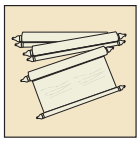
Student – Undergraduate

AUTHOR

Olivia Morris

RESEARCH MENTOR/ DEPARTMENT CHAIR

Zachary Bennett



ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Alexander The Great and Hephaestion: Censorship and Bisexual Erasure in Post-Macedonian Society

Same-sex relations were common in ancient Greece, and while having both male and female relations in one's life was the norm, Alexander the Great is almost always portrayed in modern depictions as heterosexual. This study contributes a new perspective on the greater problem of understanding the phenomenon of bisexual erasure throughout history and modern day media. Initially submitted as a 24-page research paper for Dr. Diane Cline's seminar on Alexander the Great, the research is about bisexual erasure, looking for what information is missing about the relationship between Alexander and his life-partner Hephaestion. A full 18 years ago, bisexual erasure entered the discourse in sex and gender theory, describing the phenomenon of hiding bisexual experiences in heteronormative literature, film, and popular culture. Since then, case studies have focused on contemporary instances. A compelling case study is the reception of the emotional, romantic, and sexual relationship between Alexander and Hephaestion, even as Alexander had two children by different women and married three. Bisexual erasure now extends back 2300 years with my research along with its implications in the larger focus of LGBT censorship throughout history.

Even though bisexuality was a social norm in Greek culture, the disappearance of Hephaestion is all but complete in ancient literature. I have examined five full primary source biographies of Alexander from antiquity, and observed the way scholars, popular writers and filmmakers from the Victorian era forward have treated their relationship. I have also been reading the current theoretical literature on bisexual erasure, a term first coined in 2000. My study of Alexander and Hephaestion suggests that their relationship did not fit the norm of pederasty. Normally boys and men did not have relations with others of the same age and there was almost always a financial and power difference. Hephaestion was taller and more handsome, so it might have appeared that he held the power in their relationship. Ancient biographers may have conducted censorship to conceal any implication of femininity or submissiveness this relationship dynamic might suggest. As a result, subsequent cultures would have hidden the relationship too. My work suggests that bisexual erasure is not just a modern phenomenon of 19th and 20th century sensibilities, but extends back through antiquity. Even in a culture that accepted bisexuality, their relationship was an outlier and thus treated differently. My research shows how this same-sex relationship was erased, censored, and altered to fit norms of subsequent cultures.

PRIMARY PRESENTER

Athena Richardson

STATUS

Student – Undergraduate

AUTHORS

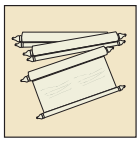
Athena Richardson

Diane Harris Cline

RESEARCH MENTOR/ DEPARTMENT CHAIR

Diane Harris Cline

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Attachment in W.G. Sebald's *Austerlitz*: Trauma and Dissociation

Trauma is increasingly understood as a permanent attachment from which survivors cannot separate themselves. But if trauma narratives about healing and being cured no longer obtain, what might a successful attachment to trauma look like? W.G. Sebald rejects the view of trauma as curable and proposes a solution to the trauma paradox in *Austerlitz*, the story of a survivor of the Holocaust who fled to England as a child on the Kindertransport and only much later as a retiree recovers dissociated memories and feels more fully alive as a result. Using the concept of dissociation and of developmental trauma theorized by Bessel Van der Kolk, I analyzed the Sebald novel to demonstrate his representation of trauma as a permanent and inescapable attachment, one that continues to haunt its survivor through intrusions, hallucinations, and flashbacks. Sebald's representation of trauma fills a gap in the literature that has been too focused on recovering from and curing trauma and not enough on experiencing and living with traumatic memory.

PRIMARY PRESENTER

Ben Streeter

STATUS

Student – Graduate

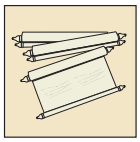
AUTHOR

Ben Streeter

RESEARCH MENTOR/ DEPARTMENT CHAIR

Marshall Alcorn

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Mass Suicide at Masada: Real Event or Myth?

Today Masada is a tourist attraction located near the Dead Sea in Israel, with a long and important history for Judaism. It is a large mountain peppered with Herodian buildings at the summit, with two paths to reach the top. In 73 CE, the last year of the First Jewish Revolt, this site was where 960 Jews supposedly performed a mass suicide so as to evade becoming Roman slaves. Josephus Flavius, a Jewish soldier turned Roman citizen, is the only historian of the time to have recorded this incident. In 1964, Yigael Yadin, an Israeli archaeologist, excavated the top of Masada to determine whether the story was true. He concluded that Josephus was not only correct about the mass suicide, but also about the structure and history of Masada. However, several scholars have since questioned Yadin's interpretations, and suggest that he had nationalistic biases that swayed his interpretations of the material culture found at Masada. The object of this project is to analyze the work of Josephus Flavius, as well as that of Yigael Yadin, in order to determine if enough material is available to confirm that indeed a mass suicide occurred at Masada in 73 CE. Data was gathered through analysis of the work of Josephus Flavius, as well as critiques of Josephus Flavius, including by the well-known scholar Louis Feldman. Other data was also gathered from analyzing books produced about Masada by the archaeologists, including Yigael Yadin and Amnon Ben-Tor, as well as critiques of the archaeology performed at Masada, including by Nachman Ben-Tor, a sociologist at the Hebrew University of Jerusalem. Preliminary results indicate that Josephus Flavius may not be the best source for what occurred at Masada, especially because he was not present for the events and has his own set of biases. These preliminary results also indicate that although Yigael Yadin's interpretation of Masada is not out of the realm of possibility, there is at present no conclusive evidence to determine that a mass suicide did occur at Masada.

PRIMARY PRESENTER

Sydney Thatcher

STATUS

Student – Undergraduate

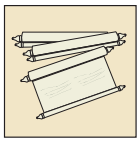
AUTHOR

Sydney Thatcher

RESEARCH MENTOR/ DEPARTMENT CHAIR

Eric Cline

HUMANITIES



COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Revolutionary Grievances: Exploring American Influence on Common French Citizens via the *Cahiers De Doléance*s

The influence of the American Revolution on the French Revolution is a topic that has received ample attention since Americans first saw the reflections of themselves as the events in France unfolded in the late eighteenth century. However, these analyses often focus on the key players of both revolutions, and how they influenced the development of revolutionary thought. What is often missed is how common French citizens, largely poor and illiterate, developed sentiments that pushed them from relative compliance in the *Ancien Regime,* to intense political activity. Fortuitously, the early days of the French Revolution provide scholars with an invaluable source that serves as a window into public sentiment across all levels of society, the *cahiers de doléances*. The *cahiers*, ubiquitous across France, were King Louis XVI's call to the citizens of France to list their grievances ahead of the Estates General of 1789.

For my senior honors thesis, I am currently examining these *cahiers* to search for American influence, implicit or explicit, intentional or unintentional, that made its way across the Atlantic Ocean into the minds of common French citizens. I am seeking to answer the question, how were common French citizens influenced by the American Revolution, if at all? The most analogous sources for the American Revolution are various grievances delivered to King George III, culminating in the local declarations of independence that predated the national Declaration of Independence of July 1776. These state and local declarations detail the first generation of Americans' grievances toward George III and their demands for a more just society. By studying these two sets of sources, I plan to explore convergences and divergences between the American and French Revolutions that go beyond the established trends in current history which focus on the influence of revolutionary leaders and shared Enlightenment philosophy. This study holds the promise of better understanding the ideology of common people and their relationship to the state by the close of the eighteenth century. By examining these similar sources, we can have a deeper appreciation for what the revolutions shared and what made them unique. Common people drove the French Revolution, and their grievances listed in the *cahiers de doléances* present our best hope for perceiving what, if any, influence the American Revolution might have had on the general French populace. Only then can we determine whether the late eighteenth century was truly an age of *Atlantic* revolutions.

PRIMARY PRESENTER

Elliot Warren

STATUS

Student – Undergraduate

AUTHOR

Elliot Warren

RESEARCH MENTOR/ DEPARTMENT CHAIR

Denver Brunsman

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Quiet Option: An Analysis of Transformations to American Covert Action

Covert action takes on multiple forms, utilizing modes and methods that conscript to desired operator outcomes and operational needs. American covert action presents a direct dichotomy to modern democracy and freedom of information, requiring a functional need for limited transparency in operation and outcome. Restrictions, controls, and pre-requisites imposed on traditional covert actions in the post-Church Committee and pre-9/11 period found a security-focused US government limited in options to successfully execute covert actions to support the global war on terror. Direct military need for reactive, combat ready, compartmentalized, flexible cover actions prompted authorization of covert action authority external from the Central Intelligence Agency, limiting Congressional purview over operational read-in and oversight authority on the new form of covert action. This paper examines the policy path taken to empower non-CIA actors with covert action authority, Church Committee constraints put on CIA post-Contra Affair, and the effects of the expanded authority on the types of covert action carried conduction in the global war on terror. The paper simultaneously conducts analysis the Congressional limitations of independent executive authority to conduct covert action through CIA, the lack of similar controls on Pentagon initiated covert action and the effects of that difference on how the White House and the intelligence community go about conduction covert action in current conflicts. The paper will examine if the imbalance of oversight on covert action, based on the operator initiating the action, threatens the democratic oversight of covert actions similar to pre-Contra conditions, and if intelligence leadership increase utilization of Pentagon initiated covert action based on increased compartmentalization and decreased authority of Congress to review and scrutinize actions and campaigns. This paper examines the effectiveness and transformation of covert action through two cases studies, a) a successful mission protecting democracy in Cold War-era Eastern Europe, and b) the dissolution of American's acceptance of covert action during Contra. The secondary review explores the transition of covert action authority during Donald Rumsfeld's leadership at the Pentagon, understanding the balance of black operations special forces team's logistical changes and limited Congressional authority to review the black operations actions under the umbrella of war campaign preparation activity. The final section reviews prescriptive policies to protect the vision of the Church Committee view of a legislative check on covert actions while working to protect the unique qualities of covert action to protect the United States from enemies of the state. Ultimately, I argue that covert action is an essential tool protecting the United States, and that while the Church Committee Era bureaucratic policies limiting the executives independent control over covert actions inside CIA are not conducive to a modern war on non-state actors, the policy prescription of transitioning paramilitary covert action authority to the Pentagon was not a long-term fix for democratic controls on a compartmentalized and top-secret operational necessity. I offer policy solutions to reexamine rules authorizing limited Congressional oversite on Pentagon covert action and offer legislative options to wind down constrictive oversight policies and paperwork on CIA covert actions to prevent a future abuse of powers using covert action.

PRIMARY PRESENTER

Jesse M. Altum

STATUS

Student – Graduate

AUTHOR

Jesse M. Altum

RESEARCH MENTOR/ DEPARTMENT CHAIR

George Fidas

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Effect of U.S. Intervention in Syria on the Turkish-Kurdish Conflict

BACKGROUND

In October 2015, President Obama authorized the US-led partnership between the Kurdish People's Protection Units (YPG) and Syrian Arab militias, known as the Syrian Democratic Forces (SDF), to assist in the fight against ISIS. While defeating ISIS was the US president's main concern, this action would ultimately lead to increased tensions between the Kurds and Turkey. Existing literature show the positive and negative effects of third-party intervention in civil wars, but the effect that third-party intervention can have on the internal conflicts during the civil war has yet to be analyzed.

OBJECTIVE

The purpose of this study is to describe the unintended consequences of the US intervention in Syria on the Turkish-Kurdish conflict, using a game theoretic model.

DESIGN/METHODS

In the game theory model, the relevant actors in the game are the following: actor X, domestic actor Y, and the third-party actor. To solve the game, the first step is to find whether or not the third-party actor will intervene in the conflict to fight actor X. Then, I analyze the third-party actor's choice to use domestic actor Y to assist in the fight against actor X. If the third-party actor chooses to use a domestic actor Y and domestic actor Y accepts the cooperation, I must analyze the effects of this cooperation. This includes investigating the unintended consequences of the third-party actor assisting domestic actor Y and the effect that the third-party actor has the outcome of the conflict. The final step would be analyzing the effect of the removal of third-party intervention on the domestic actor Y chances of winning the civil war.

RESULTS/DISCUSSION

The US' primary intention for entering the Syrian conflict was defeating ISIS. However, it did not take into account the unintended consequences of using Kurdish forces, which exacerbated tensions between Turkey and the Kurds. Once the US intervened on behalf of the Kurds, the Kurds expanded the Rojava territory across the Syrian-Turkish border, Turkish-backed forces and Syrian Democratic Forces clashed, and tensions between the US and Turkey increased. Yet, after ISIS' defeat in Raqqa, the US' hand in the conflict decreased. Kurds started losing territory, while Turkish-backed forces launched a stronger offensive at the border. Overall, the unintended consequence of intervening in the Syrian conflict underscores the importance of third-party actors' responsibility to understand the dynamics of the conflict before deciding whether to intervene in a conflict using a domestic actor.

PRIMARY PRESENTER

Cameron Bakkar

STATUS

Student – Undergraduate

AUTHOR

Cameron Bakkar

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michelle Allendoerfer

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Case for Sustainable Development in South Sudan: Not Just a Possibility, But a Necessity

Stability as a way of life is often taken for granted, but for the 1.8 million South Sudanese people living internally displaced, life has been anything but stable. This paper will establish the case that current humanitarian programs are failing to provide the assistance that the people of South Sudan need. Looking at measures implemented in current or recent conflict areas, this research will show how rural and internally displaced communities would be better served by long-term, community focused initiatives. Additionally, this research will look to widely used and burgeoning sustainable development measures as way to build a strong foundation for the people of South Sudan to rebuild their lives in the future. Sustainability is rarely addressed in situations of conflict and new development, but this study will show that not only is it possible to introduce sustainability in such conditions, but that sustainability can be an effective tool in improving the stability and conditions of South Sudanese people.

By nature, this research will draw from examples of development measures in other developing states, and apply them as models for future initiatives in South Sudan. Though the country is in a relatively unique situation because of its brief and tumultuous history, it is useful to apply the mistakes and successes of other states in their efforts to move towards development. Ultimately, this research hopes to contribute to the ongoing discourse on new trends in international development, and bring attention to a country desperately in need of new ideas. Rarely do the people of South Sudan get attention from the international community, despite the constantly deteriorating humanitarian conditions in the country. This research hopes to shed some light on a situation which needs more than short-term solutions, and prove the people of South Sudan can and must begin to prepare for their future.

PRIMARY PRESENTER

Suzanne Cole

STATUS

Student – Undergraduate

AUTHOR

Suzanne Cole

RESEARCH MENTOR/ DEPARTMENT CHAIR

David Rain

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

A Discussion of the Chinese Government's Response to Internal Migration to Beijing

Using ethnographic data from Beijing, participant observation focus groups, semi-structured interviews and background research, this article examines the interplay of narratives of the Chinese government, academics, and everyday people regarding internal migration to Beijing, aiming to address the complex societal issue of why individuals continue to migrate to Beijing despite clear resistance measures from those in the government and on the ground. First, there is a clear disconnect between migrant workers' and non-local *hukou* holders' motivations for migrating regarding education and job opportunities, and the Chinese government's attempted solutions both in policy and practice to discourage migration through mystical offers of local *hukous* and lavish housing. Secondly, although there is a broad understanding that Beijing's population is outgrowing its resources, how and who regulates this growing phenomenon continues to lack consensus. Lastly, there exists internal pushback from local Beijing residents for further assimilation of migrant workers and non-local *hukou* holders into Beijing society, preventing efficient and effective implementation of reforms at the local level. While existing research primarily focuses on overarching government policies and reforms or, more specifically, rural migrant workers in industrial provinces, this article focuses on non-local *hukou* holders as well as migrant workers in Beijing; and their everyday interaction with government policies, examining their motivations and expectations for migration, as a method of analyzing policies effectiveness. Immigrants to Beijing accept an often marginalized livelihood in Beijing in search of better access to resources, education, and job opportunities, and seek a more equitable system of their access to goods. This article analyzes the various discourses among different populations in Beijing, ultimately, offering policy recommendations for the political and cultural context of 21st Century China.

PRIMARY PRESENTER

Hannah Corn

STATUS

Student – Undergraduate

AUTHOR

Hannah Corn

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tobias Greiff

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

NGO-Led Development and Sustainability in African Desert Climates

A major trend in the development arena has been the move away from states and towards NGOs as the primary implementers of development projects. However, the ability of NGOs to achieve their objectives, especially those which require long-term engagement, has been insufficiently examined. This study explores the topic of NGO-led environmental and agricultural development projects in the drylands of southern Africa. This research uses Namibia as a case study, focusing on the //Kharas region, which has been experiencing drought-like conditions since 2012. The //Kharas region provides an illustrative and extreme example of the challenges faced by development actors in African drylands. As such, analysis of this case offers insights for other countries experiencing arid conditions as a result of climate change. Analytical methods used in this study include qualitative analysis of semi-structured interviews conducted with farmers in the //Kharas region, as well as interviews with Washington, DC-based development practitioners. This research ultimately argues development projects, particularly those which address longer-term environmental issues such as land degradation and climate change, require sufficient host government buy-in to be successful and achieve long-term sustainability. The findings have implications for improving our understanding of the factors necessary for sustainable development in drylands, an area of increasing importance due to the specter of climate change.

PRIMARY PRESENTER

Jillian DiPersio

STATUS

Student – Undergraduate

AUTHOR

Jillian DiPersio

RESEARCH MENTOR/ DEPARTMENT CHAIR

David Rain

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Qatari *Kafala* System and International Inaction

In 2010, FIFA named Qatar as the host of the 2022 World Cup, despite the fact that Qatar is home to an institutionalized form of human trafficking called the *kafala* system. By choosing Qatar as the World Cup host, the international community implicitly accepted the *kafala* system and demonstrated a willingness to overlook the reality that Qatar's $327 billion economy was built on the backs of enslaved migrant laborers. This case study seeks to answer the following question: How has this country—which relies on such an oppressive labor system—maintained strong political and economic relationships with countries that claim to champion civil liberties and human rights?

This study tests two hypotheses: (1) The Qatari government has been able to maintain the *kafala* system without negatively impacting bilateral relations because foreign leaders have ignored the system's abusive and exploitative qualities for reasons of economic self-interest. (2) The Qatari government has not substantively reformed the *kafala* system because the international community has no leverage over the Qatari government.

To test the first hypothesis, the foreign policy doctrines of Qatar's primary economic allies are evaluated to gauge commitment to the protection of human rights and civil liberties abroad. The stated doctrine of each country is compared to governmental policy regarding Qatar. This comparison reveals a disconnection between stated doctrine and its implementation that appears to reflect a prioritization of economic interests over human rights.

For the second hypothesis, annual reports of the International Labour Organization (ILO) Committee of Experts on the Application of Conventions and Recommendations are analyzed to track Qatar's responsiveness to the ILO. The reports show that Qatar consistently violates conventions and disregards the Committee's recommendations. Accordingly, the *kafala* system has persisted in part because the ILO cannot force Qatar to adhere to agreed-upon conventions.

Given the complexity of global politics and economics, it is likely that a combination of factors have resulted in the impunity with which Qatar maintains its *kafala* system. This research presents preliminary evidence of two of these factors: the willingness of foreign leaders to overlook the human rights abuses of the *kafala* system to preserve their economic interests, and the impotence of international organizations set up to enforce accepted standards for labor practices and human rights. More research must be done to confirm these findings, to understand which of these two factors holds more explanatory power, and to reveal other contributing factors.

PRIMARY PRESENTER

Mary Fulham

STATUS

Student – Undergraduate

AUTHOR

Mary Fulham

RESEARCH MENTOR/ DEPARTMENT CHAIR

Heidi Hiebert

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Beyond Spiritual Security: An Examination of the Perceptions of the Moroccan State's Extremism Prevention Through Religious Institutions

The purpose of this paper is to review the state's soft-power approach to the prevention of violent extremism in Morocco and analyze the public perceptions of its success at the level of society. This study first provides a definition of extremism and its relevance as a topic of concern in Morocco following the Casablanca Bombings of 2003. This is followed by an examination of the moderate Islam promulgated by the state, and then an exploration of the relevant religious reforms made by King Mohamed VI as Commander of the Faithful. Through such reforms, the state has fortified the religious sphere in an effort to guarantee the spiritual security of Morocco. Through interviews with academics, civil servants, religious leadership and community organizers, this paper provides a multi-faceted look at the perceptions of the shortcomings of the state's approach to preventing extremism through its religious institutions beyond such spiritual security. While the state has been active in institutional reform and promotion of moderate Islam, individuals within these religious institutions are limited in their ability to work outside the religious framework of the state, preventing them from interacting with crucial populations and participating in grass-roots partnerships with civil society organizations. A detailed examination of the role of the Oulema Relais and peer educator is undertaken in this paper as examples of exceptionally empowered mediators whose extremism prevention approaches are successfully achieved by positionality as both a part of and outside the religious sphere.

PRIMARY PRESENTER

Calla Gilson

STATUS

Student – Undergraduate

AUTHOR

Calla Gilson

RESEARCH MENTOR/ DEPARTMENT CHAIR

Khalid Saqi

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Constructing the South China Sea: A Pentadic Analysis of American Narratives, 2009-2016

Though the South China Sea (SCS) territorial disputes have attracted much attention in the United States, there is a dearth of scholarly research on their discursive construction. Americans clearly care about the SCS, but nobody has investigated how, when, or why particular American narratives emerged and evolved. Given this research gap, this article develops a longitudinal form of Kenneth Burke's pentadic analysis to study American narratives of the SCS. Examining editorials from the *New York Times* and *Wall Street Journal* from 2009 to 2016, this article finds that elements of a dominant narrative emerged in 2014 in response to both material and discursive developments. This article then demonstrates the manner in which this dominant narrative has delimited the scope of legitimate U.S. policy options.

PRIMARY PRESENTER

Zachary Haver

STATUS

Student – Undergraduate

AUTHOR

Zachary Haver

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Sutter

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Man-Made Radical? Interrogating Manhood in the White Nationalist Movement

When men feel that they are unable to achieve masculinity through normative means, where do they turn? This study examines a non-normative and understudied pathway to achieving masculinity: membership in an extremist organization. This research seeks to understand how extremist organizations exploit opportunities of unrealized manhood to recruit and retain members. To understand this intersection, this research examines masculinity in white nationalist and neo-nazi groups. In describing this relationship, it examines the potential implications of masculine ideals and conceptions of manhood present in American and German society today. The research relies on qualitative data analysis of white nationalist and neo-nazi propaganda and semi-structured interviews with white nationalists. By demonstrating that white nationalists may be motivated by a desire to fulfill societal expectations around masculinity, the research offers insights for theorists seeking to better understand the process through which individuals adopt extremist views and actions. The findings are simultaneously relevant for policy, as they suggest that to successfully prevent radicalization and counter extremism, policy initiatives must address these individuals' desire to be seen, and see themselves, as masculine.

PRIMARY PRESENTER

Amber Herrle

STATUS

Student — Undergraduate

AUTHOR

Amber Herrle

RESEARCH MENTOR/ DEPARTMENT CHAIR

Seamus Hughes

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

A Century of Unsustainable Tourism in the Caribbean: Lessons Learned and Opportunities for Cuba

The past 50 years have seen unprecedented environmental degradation in the Caribbean. Since the mid-eighties, the region has lost 50 percent of coral cover and 42 percent of its magroves, considered vital for shoreline protection and as a nursery area for a myriad of species. Landscape modification due to tourism development is considered one of main contemporary drivers of habitat loss in the Caribbean.

The advent of long-haul airlines in the '50s coincided with the decline of the plantation economy and a search for an economic replacement. With support from intergovernmental organizations, much of the Caribbean adopted a mass tourism model upon which it remains dependent to this day. Unfortunately, tourism at such a scale was poorly planned and often unregulated, resulting in serious environmental impacts.

However, Cuba has developed differently from any other country in the Caribbean, with far less-intensive coastal development. However, given recent political changes, including the normalization of relations with the United States, Cuba now faces the same type of pressures that resulted in environmental destruction throughout the Caribbean over the past half century. This era of change creates a new set of challenges for Cuba to balance economic development and protection of its natural ecosystems.

While there are concerns about the growth of tourism in Cuba, if implemented responsibly, tourism also represents a significant opportunity to advance the economic and environmental well-being of Cuba's coastal communities. With new reforms and openings to the private sector instituted by Raul Castro each year, our case studies and primary research shows how these new opportunities may be taken advantage of, both for the economic development of the Cuban private sector, and the preservation of Cuba's unparalleled biodiversity and beauty. Small-scale tourism development represents a unique opportunity to advance conservation as well as historic preservation goals through the engagement of local communities.

PRIMARY PRESENTER

Rachael Hughen

STATUS

Student – Undergraduate

AUTHORS

Rachael Hughen

David Guggenheim

Ximena Escovar-Fadul

Melissa Mooney Walton

RESEARCH MENTOR/ DEPARTMENT CHAIR

David Guggenheim

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Responding to Censorship: The Islamic State on Twitter

The research question this article attempts to answer is: Why do figures in power enact harsh censorship demands on relatively harmless constituencies that can pose greater threats after repression? In response to the question, the research analyzes the use of Twitter and encrypted applications by IS sympathizers online.

While common sense points to the massive number of suspensions as an indication that IS is losing the online battle on Twitter, the picture is not as clear cut. This article argues that Twitter suspensions are not an effective counter-terrorism policy within the fight of the digital Caliphate. This is not to say that IS is not susceptible to damage through these social media platforms. However, more importantly, the article will critique the overall efficacy of Twitter's approach to this issue, using insights from arguments about censorship.

The argument is based on evidence from a small sample size of 112 IS sympathizer accounts, some of whom have faced suspension, collected over one month. The insight gained is a snapshot into the inner workings of the IS sympathizer community during a highly-scrutinized period of Twitter's terms and services for its vast suspensions. The analysis provided also looks at specific case studies of individuals arrested for IS-related crimes in the U.S. and their use of Twitter to gain insight on the topic of online censorship and digital policing as a form of social engineering.

This research shows the ever-changing structure and response of the hardened IS sympathizer community on Twitter due to enhanced censorship regulations. But, the increased repression of this group is ineffective and does not solve the problem of limiting the IS sympathizer community online as the group adjusts to its new boundaries. The snapshot approach can be used to extrapolate lessons for the inevitable future iteration of FTOs like IS in a dynamic technological landscape.

PRIMARY PRESENTER

Armand Jhala

STATUS

Student – Undergraduate

AUTHOR

Armand Jhala

RESEARCH MENTOR/ DEPARTMENT CHAIR

Seamus Hughes

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Transnational Identity and Business in Cross-Strait Relations: Taiwanese Businesspeople in the Political Economy

Are transnational businessmen apolitical entities who do not engage in politics despite social pressures and the rise of nationalism? This article seeks to examine the changing political roles of Taiwanese businesspeople (*Taishang*) in cross-Strait relations. In 2016, the election of Taiwanese President Tsai Ing-Wen was seen as the Taiwanese public's response to resist further social, political and economic ties with China. Furthermore, the Chinese President Xi Jinping's toughening stance on China's Taiwan policy, has also put Taiwanese businesspeople in a bind. With rising labor costs and competition from local Chinese firms, Taiwanese businesspeople no longer enjoy the same benefits in China as they did in the 1980s and early 2000s. This research seeks to answer such questions: are *taishang* more likely to get behind Taiwan's Southbound policy or Beijing's pro-unification ideology? Has their years of working with Chinese people and living in China driven their decisions to assimilate or leave? Using 25 qualitative interviews conducted in Guangzhou, Shanghai and Taiwan with *Taishang* in 2017, this research analyzes what factors drive Taiwanese businessmen to stay in China in the current political and economic climate. Previous literature has argued that the *taishang* act as a "linkage community" in cross-Strait relations, however this article finds that *taishang's* real impact may be limited at best due to globalization trends.

PRIMARY PRESENTER

Lauren Kao

STATUS

Student – Undergraduate

AUTHOR

Lauren Kao

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Sutter

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Formalizing Through Finance: A Case Study with UNICS

This paper seeks to analyze the microfinance industry in Yaoundé, Cameroon through the lens of the microfinance institution Unity Co-operative Society (UNICS). The main question guiding this study deals with whether or not UNICS is encouraging a shift to the formal sector through their work with business people. Other questions relating to repayment rates and subsequent economic development also remain pertinent to the information found. Working mostly in the Credit Department at the UNICS Yaoundé Marche Central Branch and with microfinance and economics experts in the area, data was collected through interviews and fieldwork conducted regarding the former questions. In total, it is found that UNICS and microfinance institutions as a whole, seek to encourage formal sector growth through working with businesspeople in the informal and their desire to work with mainly formal sector businesspeople, in some customers causing a shift from the informal to the formal sector. Repayment rates however do not determine the success of any aspect of a customer's business or encouragement from institutions. And overall, while microfinance does contribute to socioeconomic growth, it is found that microfinance has deviated from its original goal of helping the poor and with the poor being left behind, it is hard for there to be real economic development.

PRIMARY PRESENTER

Leah Kellenberger

STATUS

Student – Undergraduate

AUTHOR

Leah Kellenberger

RESEARCH MENTOR/ DEPARTMENT CHAIR

Christiane Magnido

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Role of NGOs in Promoting Sustainable Livelihoods: Lessons from Ecotourism in Indonesia

Ecotourism occupies a rare intersection between economic development and environmental conservation. As a result, ecotourism has long been promoted by conservation NGOs attempting to transition communities to more sustainable livelihoods, with varying levels of success. This research project evaluates the factors that contribute to NGOs' ability to encourage sustainable livelihoods through ecotourism, looking specifically at two emerging ecotourism destinations in Indonesia: Raja Ampat and East Flores. In both locations, NGOs have encouraged communities to avoid destructive practices, such as dynamite fishing or hunting marine megafauna such as manta rays, sharks, and whale sharks. In Raja Ampat, NGOs successfully promoted indigenous conservation practices and community-based ecotourism networks such as homestays to promote more sustainable practices. In contrast, local communities in East Flores still rely on destructive fishing practices, and local NGOs are just beginning to conduct research and stage interventions with these communities in the hope of introducing ecotourism as an alternative livelihood.

The questions this research seeks to answer are, "What role do NGOs play in the development of sustainable livelihoods through ecotourism promotion in Indonesia? How can the successful methods utilized in Raja Ampat be applied to development in East Flores?" Data is based on community-based participatory research conducted in Raja Ampat and East Flores over 5 months, including over 100 qualitative interviews, 40 structured surveys, and daily participant observation alongside local communities and NGOs. In analyzing the challenges and successes of NGO strategies in Raja Ampat, the research argues that NGOs in East Flores should apply the framework for best practices utilized by NGOs in Raja Ampat to promote three vital pillars of sustainable development: ecology, equity, and economy. Initial findings indicate that there are three key strategies promoted by NGOs to successfully transition communities to more sustainable livelihoods: 1) enforcement and community policing efforts to reduce illegal fishing; 2) education of target communities and identification of key influential members of society; and 3) long-term endurance of program efforts and development of infrastructure essential to ecotourism initiatives. The research has important implications for our understanding of NGO roles in partnering with communities to encourage the development of sustainable livelihoods, both in Indonesia and globally.

PRIMARY PRESENTER

Chloe King

STATUS

Student – Undergraduate

AUTHOR

Chloe King

RESEARCH MENTOR/ DEPARTMENT CHAIR

Kathleen Merrigan

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Have We Emboldened The Enemy?: An Examination of the Relationship Between Islamic State Territory and Islamic State Terrorism

How does the Islamic State react to territorial pressure and territorial loss? By shrinking the Islamic State's territory, do opposing forces give the Islamic State more motivation to conduct acts of terrorism? Policymakers and scholars have extensively debated hypotheses on how opposing forces can most effectively diminish the threat of the Islamic State. Much of the debate rests on the assumption that when the Islamic State loses control over territory, the Islamic State's capacity to conduct and fund acts of terrorism diminishes. The assumption, however, remains largely untested.

This study challenges the assumption by testing the observable implications of those arguments which assume a positive correlation between the amount of territory controlled by the Islamic State and the Islamic State's capacity to conduct terrorism. By examining time series data on the frequency of Islamic State terrorism, the lethality of Islamic State terrorism, and the Islamic State's capacity to gather revenue by way of taxation and resource exploitation, this study concludes that the Islamic State's capacity to conduct and fund acts of terrorism is not inhibited by a loss in the amount of territory controlled by the Islamic State. Rather, the data show that when territory decreases, terrorism increases. It is thus important to consider approaches to defeating the Islamic State that do not depend entirely on the rapid reduction of the Islamic State's territory by opposing forces. The containment approach, which aims to cripple the capabilities of the Islamic State without significantly reducing its territory, should therefore be taken into consideration when working to combat and mitigate the terrorist threat posed by the Islamic State and other insurgent groups.

PRIMARY PRESENTER

Alisa Laufer

STATUS

Student – Undergraduate

AUTHOR

Alisa Laufer

RESEARCH MENTOR/ DEPARTMENT CHAIR

Stephen Biddle

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Sport as a Catalyst for Peace? The Legacy and Prospects of Inter-Korean Olympic Sport Diplomacy

The 2018 PyeongChang Olympic Winter Games took place from February 9 to February 25, 2018. In addition to highlighting South Korea's economic, technological, and cultural prowess, PyeongChang 2018 gained attention for the degree and effectiveness to which sport dialogue and diplomacy were carried out between South and North Korea. In the past and as evident during PyeongChang, both states have actively utilized sport as a means of facilitating or achieving some larger political goal. This study seeks to answer the question of how sport diplomacy, specifically within the Olympic framework, has manifested the reality of, shaped, and affected inter-Korean relations. It examines the history of such efforts from post-Korean War through PyeongChang 2018, assessing the strategic calculations and motivations of each party and determining whether a pattern exists as to how, when, and why sport diplomacy is carried out.

The study brings together primary sources of news articles, official government statements, and surveys with secondary sources of opinion pieces, think tank publications, and scholarly journals. The analysis is further supplemented by firsthand research conducted in PyeongChang, documenting the final match played by the joint Korean women's ice hockey team. The research attests to the difficulty of separating sport and politics in inter-Korean relations, with the Olympics serving as a particularly high-profile and low-cost tool to test foreign policies, send diplomatic overtures, satisfy domestic political objectives, create a sense of pan-Korean identity, and sustain the notion of reunification in public discourse. However, despite its value, decades of Olympic sport diplomacy have failed to engender a permanent political thaw on the Korean peninsula, largely confined to symbolism and temporary respite from military tension. It has yet to be determined whether or not PyeongChang 2018 will break loose from this cycle, but it nevertheless points to how sport can serve as a unique catalyst for cooperation that can potentially spill over into more lasting areas in international affairs.

PRIMARY PRESENTER

Bomie Lee

STATUS

Student – Undergraduate

AUTHOR

Bomie Lee

RESEARCH MENTOR/ DEPARTMENT CHAIR

Gregg Brazinsky

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Examining the 2007 Redenomination of the Ghanaian Cedi on the Disinflation Process Using the Chow Structural Break Test & Vector Autoregression

Over the past 40 years, Ghana has experienced high and variable rates of inflation. Although inflation is no longer as high or volatile compared to the 1970's and 1980's, it remains stubbornly elevated relative to economies of similar size. Conventional disinflation policies involve countercyclical monetary policies, reducing fiscal expenditure, and comprehensive economic and political reform. The policies in turn can be bolstered through a currency redenomination; when the nominal value of all prices is reduced. A number of countries have pursued this strategy, with recent examples being Turkey (2005), Romania (2005), Belarus (2006, 2016), and the country in question, Ghana (2007). This raises the question of whether currency redenomination is an effective qualitative tool in the disinflation process. This question is important because of its potential as an important tool in the disinflation process in countries struggling with high and variable rates of inflation. Unfortunately, existing literature has been deficient, and no appropriate techniques have been employed to examine this question. Thus, the goal of this paper is to examine the impact of the Ghanaian currency redenomination in 2007 on the disinflation process using appropriate statistical techniques; the Chow Test and Vector Autoregression (VAR).

This paper employed monthly time series data from January 2000 to September 2017 provided by the Bank of Ghana. The results gathered in this paper showed that while the Chow Test found a structural break before and after the date of redenomination, the vector autoregression VAR(4), was inconclusive as to whether the policy itself directly affected the disinflation process. These results suggest that economists should devote more attention to the potential of currency redenomination as a tool in the disinflation process.

ORIGINALITY/VALUE

This paper is one of few studies which has investigated the impact of currency redenomination, especially in Africa and Ghana specifically.

PRIMARY PRESENTER

Riki Matsumoto

STATUS

Student – Undergraduate

AUTHOR

Riki Matsumoto

RESEARCH MENTOR/ DEPARTMENT CHAIR

John Volpe

INTERNATIONAL AFFAIRS

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Climate-Change Preparation and Environmental Peacemaking in Cyprus

Climate change is a global threat that will not affect all countries equally. One of the most vulnerable countries in Europe to climate change is Cyprus. The nation also faces an equally intractable political problem, the division of the island since 1974 between the Republic of Cyprus, and the unrecognized Turkish Republic of Northern Cyprus. The island of Cyprus offers an interesting case study of how preparation for climate change affects, and is affected by, existing conflicts between populations. This research explores how various areas of sustainability in Cyprus, particularly the acquisition of water, agriculture and ecological efforts, are complicated by the so-called "Cyprus Problem." In addition, this research seeks to explore how efforts to prepare for climate change and other environmental concerns, are being used as a way for the two sides of the conflict to work together. Existing literature has often focused on climate change as an exacerbating factor in existing conflicts, but there is far less research on the potential of climate change preparation as a way to build peace. This research seeks first and foremost to look at sustainability efforts on the entire island of Cyprus. However, due to the ubiquity of the Cyprus Problem, this research also seeks to shine a light on peacebuilding efforts through the lens of sustainability.

PRIMARY PRESENTER

Nikolas Michael

STATUS

Student – Undergraduate

AUTHOR

Nikolas Michael

RESEARCH MENTOR/ DEPARTMENT CHAIR

Lisa Benton-Short

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

International Law in the Art World: Exceptions to States' Adherence to Treaty and Customary International Law

In the past decade, international politicians have been obsessively seeking to eliminate the threat of terrorist groups in the arena of politics and power. Though we have come a long way from where we stood twenty years ago, insurgency groups consistently find alternative methods to fuel their existence. In today's international and political struggle for power, financing acts of terrorism have approached much more creative methods. International bodies of politics, power, and law have become intertwined with the art market. In fact, buyers and sellers are being warned to be extremely cautious handling the transactions involving antiquities arriving from the Middle East or areas of development because of their possible link to ISIL, Al Qaeda, and various other groups. In order words, terrorist organizations are not only looting cultural property from the states in which they operate but, in order to generate income, they also sell these artifacts. These antiquities often carry a significant, often priceless, historical and cultural meaning to their country of origin. Monetarily, they are also extremely valuable to both a buyer adding to his collection, and a seller increasing his portfolio. And though art dealers may not be keen on supporting any type of transaction involving terrorist organizations, the lack of transparency within the system makes it increasingly hard to tell which potential acquisition has dangerous consequences. Often times, these risky consequences are ignored for the prestige of the possession of such items.

Though dealing with art is not the only source of income for terrorist groups, securing any financial acquisitions is imperative to their existence and success. However, the burden of the continued distribution of antiquities does not rest entirely on these organizations. In order for this kind of market to exist, there must be a demand. Indeed, as we have seen over the past decade, art dealers are more than happy to ignore the provenance of certain pieces. Selling these types of antiquities in the black market involves the transfer and handling of a lot of money - millions of US dollars. At this price level, the antiquities are often associated with the prestigious actors or even governments. Too often, state governments do not take actions "required" by the body of international law under which the states carry out their relations with one another. The outcome of this negligence is contributing to the threats posed by and the existence of terrorist organizations.

In order to evaluate the relationship and overlap between art and international law, this paper will first look cases of art dealing with the United States, Cambodia, and Afghanistan. The paper will point out the actions of these governments and actors within them, notably Hobby Lobby, the Khmer Rouge, and the Taliban, respectively. The paper will then move onto the answer several questions regarding international law relating to each of these cases.

PRIMARY PRESENTER

Kavita Oza

STATUS

Student – Undergraduate

AUTHOR

Kavita Oza

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mika Natif

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Consolidation of Power: Iranian Foreign Policy Towards Iraq, 1978-1988

Following its revolutionary movement throughout 1978, Iran's relations with Iraq began to dissipate in the winter of 1979–1980. This paper seeks to answer the question, "Why was Iran's foreign policy towards Iraq sometimes more cooperative and sometimes less cooperative, January 1, 1978–December 31, 1988?" It presents a detailed chronology of domestic governmental organization and foreign policy towards Iraq, highlighting a key foreign policy turn during this time: the decision to move from a defensive policy of reclaiming Iranian territory to an offensive one of invading Iraq to overthrow the Ba'ath regime in June 1982. Alongside the chronology, the paper examines and applies Kimball's theory of factionalism and McDermott's prospect theory to effectively explain the motives behind Iran's foreign policy objectives. Factionalism examines the consequences of emerging factions after the Iranian Islamic Revolution, and the ways various factions and decision makers associated with them attempted to preserve their power. Prospect Theory explains how factionalism contributed to a domain of gains or losses domestically, which influenced the amount of risk decision makers were willing to tolerate in foreign policy. They work in tandem to conclude that factionalism's clout over Iranian decision maker's perception of risk led to the creation of increasingly uncooperative foreign policy towards Iraq after the winter of 1979–1980, climaxing in the invasion of Iraq in 1982.

Contrary to the traditional line of thought that a state's foreign policy aims to respond to the actions of another country, this research contends that domestic political issues primarily influence foreign policy. Additionally, the implications of Iran's foreign policy and its decision-making process remain meaningful to modern decision makers addressing states that externally appear to have no rational motive for their foreign policy, yet internally attempt to consolidate power under one faction. This paper relates its findings on Iran's foreign policy from 1978–1988 to modern day North Korea and her relationship with South Korea and the United States.

PRIMARY PRESENTER

Virginia Polik

STATUS

Student – Undergraduate

AUTHOR

Virginia Polik

RESEARCH MENTOR/ DEPARTMENT CHAIR

Lori Gronich

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Outbound Student Mobility in the Context of Lebanon's Sectarian Environment

The division of Lebanon's society by sect, compounded by a decentralized and consociational government, has led to a highly fragmented society. Largely influenced by their roles during the state's historical development, sects maintain different nationalist viewpoints, influencing their political ambitions and decisions. The confessional structure of government grants each sect more autonomy to dictate its own affairs, including the ability to establish separate school systems and insert divergent nationalist views in schools, limiting the interaction between sects from adolescence onward. However, as students exit the sectarian environment, such as when pursuing higher education abroad, they have a potential opportunity to adopt a different view than that imposed by their experience in Lebanon. This study aims to identify if and how students' removal from a sectarian environment influences their views of Lebanese national identity.

Recent scholarship has focused on the impact of sectarianism within Lebanon's education system. However, in order to determine the depth of students' sectarian views, it is important to understand what happens when they are removed from this environment. In order to do so, this study surveys over 65 Lebanese students who are currently attending university in the United States. Questions focus on students' educational and familial backgrounds, their preexisting notions of sectarianism, and their current perceptions of sectarianism. To fully understand the notion that students' sectarian and nationalist identities are malleable based on their environment, further research would be required to survey students who have both exited and re-entered Lebanon. That said, the results of this study indicate that the Lebanese national identity, which is currently seen as interlinked with sectarian division, may be more independent than previously understood. The study has implications both for understanding the malleability of sectarianism in Lebanon and the impact of international education on a student's national identity.

PRIMARY PRESENTER

Youmna Sirgi

STATUS

Student – Undergraduate

AUTHOR

Youmna Sirgi

RESEARCH MENTOR/ DEPARTMENT CHAIR

James Williams

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Andean Forests, Indigenous Communities, and Environmental Change In Peru's Cordillera del Vilcanota

In Peru, Andean forests are in danger of extinction due to the overexploitation of resources, the proliferation of nonnative species, and climate change. The health of this native ecosystem is intertwined with the way of life of the Quechua-speaking indigenous farmers who inhabit the high mountains. This study, through in-depth interviews and participant observation in the Indigenous Communities of Huilloc and Patacancha, identifies and interrogates the conservation strategies employed by indigenous people and Nongovernmental Organizations in the Vilcanota Mountains of Cusco, Peru, which harbor some of the last remaining groves of native forest. Several conservation strategies are analyzed, including the establishment of co-managed Private Conservation Areas, the introduction of sustainable forestry policies, and sustainable economic development projects in the communities. I find that the initiative represents a fusion of top-down and bottom-up conservation; namely, a strategy has emerged which emphasizes communal land management, but also monetizes environmental labor for conservation NGOs. This arrangement appears to have set off an era of forest restoration in the region, but indigenous communities still clash with disruptive environmental and social change.

PRIMARY PRESENTER

Eric Teller

STATUS

Student – Undergraduate

AUTHOR

Eric Teller

RESEARCH MENTOR/ DEPARTMENT CHAIR

Cynthia McClintock

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Sustainable Development of Orbital Resources

Space is getting crowded. While distances between planets and solar systems are so great as to defy description, only a small part of the space around Earth is particularly useful to humans. That small part is rapidly being filled with operational satellites and useless "space junk". Space debris and potential mitigation have been topics of discussion for several decades but may soon come to a head. Donald Kessler, one of the first NASA scientists to study orbital debris, has stated that the mass of debris in orbit has passed a crucial "tipping point". In other words, the concentration of space debris in low earth (LEO) and geosynchronous orbit (GEO) will continue to worsen via propagating collisions, even without any further launches from Earth.

When the new space observation telescope (Space Fence) comes online in the next few years, the number of pieces of tracked debris will increase by an order of magnitude. It is likely that this *apparent* increase in orbital debris will cause consternation in the public and in Congress. Therefore, now is the time to prepare for significant action with regards to orbital debris mitigation.

This paper proposes the creation of an international space debris mitigation project, inspired by the International Space Station (ISS). The proposed International Clean Up Station (ICUS) would leverage political lessons learned from the ISS negotiations as well as the ISS's black box technological architecture.

Mitigating concerns over active debris removal being used in an anti-satellite (ASAT) capacity would be a major benefit of ICUS. Before any piece of debris could be targeted for removal by the system, each member of an international governing organization would be required to turn their individual "key". In this way, major space powers such as the United States and Russia could be assured that no country would be unable to use ICUS against an opponent's space assets. This type of cooperation would have a stabilizing effect on the US-Russia relationship, especially with regards to suspicion of secret ASAT weapons development.

PRIMARY PRESENTER

Claire Wilhelm

STATUS

Student – Graduate

AUTHOR

Claire Wilhelm

RESEARCH MENTOR/ DEPARTMENT CHAIR

Peter Hays

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Geopolitical Relations: Uganda's Role in the Development of the River Nile

This study examined the geopolitical relations of the Nile Basin by looking at Uganda as a case study, and to analyze Uganda's use and development of the River Nile. It looks at the history of transboundary politics and treaties in the region and of Uganda's development projects of the region. The project discusses modern relations and agreements, with a focus on the most recent agreement between the Riparian States, the Cooperative Framework Agreement, and how Uganda fits into them with regards to their interest in hydropower development within their borders on the Nile. It then explores possible future developments on the river and the potential for future conflict in the region, and finishes by making recommendations for the Nile Basin and Uganda. The whole project is looked at using the sustainable development paradigm.

This study was conducted over six weeks through primarily document review and eight expert interviews. Documents provided historical information and facts and statistics on the modern development and geopolitical relations of the Nile Basin. Field based interviews served to enhance and further the information gathered in document review. All interviewees were experts in their fields and most worked within the Ugandan Ministry of Foreign Affairs, the Ugandan Ministry of Water and Environment and their directorates. The study was conducted in accordance to ethical considerations and all wishes of interviewees were upheld throughout the paper.

The researcher found that modern geopolitics of the region have been greatly influenced by the 1929 and 1959 colonial agreements that gave Egypt power of the Nile. Today geopolitics focus on changing this status quo, despite protests from Egypt. Uganda must balance its position as both an upstream and downstream Riparian state, and could be a key middle ground country for maintaining peace in the region by appealing to both sides of the water sharing debate. Uganda's primary investment in the river is hydropower, and so they must balance the want to release enough water to generate electricity, and preserving their water catchments to protect the resource for long term use. Other than hydropower, which is a hotspot for international criticism due to environmental and cultural impacts, Uganda has the potential to develop irrigation from the Nile and Lake Victoria that could increase agricultural yields. Uganda's position in the Nile Basin makes it unique both in its ability to use and regulate the White Nile, and in the political framework of the region.

PRIMARY PRESENTER

Jordan Williams

STATUS

Student – Undergraduate

AUTHOR

Jordan Williams

RESEARCH MENTOR/ DEPARTMENT CHAIR

Charlotte Mafumbo

INTERNATIONAL AFFAIRS

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Welfare State Across the Green Line: The Effects of Israeli Economic Policy on the West Bank Settlement Enterprise

Like most of the discourse surrounding the Israeli-Palestinian conflict, the Israeli settlement enterprise has often been viewed through the lens of religious, political and ideological extremism. However, geographic phenomena do not take place in a vacuum void of economic influence. In reality, many Jews emigrating to West Bank settlements in the past few decades have chosen to do so in search of a lower cost of living and better quality of life, a seemingly impossible combination that has been made feasible by a high degree of government economic intervention in the Occupied Territories. Yet this intervention directly contradicts the orientation and principles of Israel's increasingly neoliberal and market-oriented economy. This research tests the theory of Professor Danny Gutwein of the University of Haifa, who argues that the State of Israel's transition toward neoliberal economic policy is a direct causal mechanism of settlement population growth. To test Gutwein's theory, this research uses an econometric analysis of economic, demographic and political indicators, and is substantiated by qualitative data gathered from interviews with three settlers. The statistical models constructed indicate that decreasing rates of Israeli government consumption as a percentage of GDP has had a statistically significant effect on population growth in West Bank settlements. They also show that the Knesset's political orientation has had no statistically significant effect on settlement growth. These findings have important ramifications for the current discourse surrounding Israeli society's relationship with the settlement enterprise. While Gutwein argues that settlements act as a compensatory mechanism for Israel's Right, this research indicates that the foundation of the Israeli settlement enterprise is not merely a left-wing versus right-wing issue. In addition, this research offers new considerations for Israeli policymakers as they critically evaluate the state of socioeconomic equity in Israel today, and the extent to which those inequities are exacerbating the fundamental tensions found in the Israeli-Palestinian conflict.

PRIMARY PRESENTER

Hillel Zand

STATUS

Student – Undergraduate

AUTHOR

Hillel Zand

RESEARCH MENTOR/ DEPARTMENT CHAIR

Arie Dubnov

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Transgenerational Effects of Parental Ethanol Consumption on Offspring Ethanol Sensitivity

The fruit fly *Drosophila melanogaster* is a useful model for studying ethanol metabolism, because this species encounters ethanol derived from fermenting fruit in the wild. It was found that increased resistance to ethanol could provide a fitness advantage to flies that exist in temperate regions where the food they are exposed to contain 6–7% more ethanol than those in the tropics. Research conducted on *Drosophila* has shown that diet-induced epigenetic changes are heritable, however, these studies did not involve ethanol. My research investigates transgenerational effects of ethanol consumption in adult *Drosophila melanogaster* on tolerance and the behavior of progeny. I studied whether epigenetic changes as a result of ethanol consumption in *Drosophila melanogaster* are heritable and visible in the offspring of ethanol-fed parents. The methodology involved using Capillary Feeder Assays (CAFEs), where *Drosophila* were fed a liquid media containing sugar, water, and ethanol. There were four treatments that included ethanol-fed males, ethanol-fed females, and the controls for each sex which were fed media without ethanol. After feeding each treatment for one week, we combined each combination of treatments into breeding vials to have ethanol-fed females mating with ethanol-fed males, ethanol-fed females mating with control males, control females mating with ethanol-fed males, and control females mating with control males. Two weeks later, the progeny were collected as they eclosed and separated by sex, based on which crosses they came from. Two days after eclosion, we assayed their tolerance to ethanol by recording the time it took half the flies to drop (and lie on their backs) after exposure to 1 ml of ethanol in a vial. Statistical tests were done to test the significance of the difference in time obtained between the progeny of different crosses.

PRIMARY PRESENTER

Jasmina Abdalla

STATUS

Student – Undergraduate

AUTHORS

Jasmina Abdalla

Adam Ricker

Mollie Manier

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

MID1 Contributes to Huntington's Disease

Huntington's disease is an incurable genetic disorder caused by protein aggregation in the brain, leading to dementia, involuntary movements and ultimately death. The disease is caused by the overproduction of the mutant huntingtin protein (mHTT), which contains >35 glutamine (Q) amino acid at its N-terminus. In contrast, the normal huntingtin protein (HTT) contains approximately 20 Q. Typically, the mutant mRNA of mHTT with >35 CAG repeats is degraded prior to translation but appears to be stabilized in Huntington's disease. The Midline-1 (MID1) protein functions to stabilize the CAG repeat found in the Huntington mRNA, but the mechanism of stabilization is not known. Results from my project have shown that MID1 directly binds RNA CAG repeats, but not DNA CAG repeats. Data from electrophoretic mobility shift assays (EMSA) experiments revealed that six of the seven MID1 domains bind a short RNA sequence consisting of 20 CAG repeats. In order to determine if the binding was specific, EMSA experiments were performed with an equivalent DNA sequence consisting of 20 CAG repeats. Interestingly, no binding was observed. These results suggest a possible mechanism by which MID1 might stabilize the mutant mRNA with the longer CAG repeat with more of its domain compared to the wild type mRNA with the shorter CAG repeat. Preventing the translation of the mHTT mRNA is considered the most effective approach for defeating Huntington's disease. Therefore, understanding the binding interaction between the various domains of MID1 and CAG will provide insight for disrupting this interaction and destabilizing the mHTT mRNA.

PRIMARY PRESENTER

Addie (Anood) Abdel Jawad

STATUS

Student – Undergraduate

AUTHORS

Addie (Anood) Abdel Jawad

Angela Belic

Michael Massiah

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michael Massiah

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

An Exploration of the Morphospace of the Cypriniform Pharyngeal Jaw

The order Cypriniformes consists of over 3,000 species and makes up over one-tenth of all living bony fishes. This incredibly speciose group possesses multiple novel feeding innovations, including the loss of oral teeth, the loss of the upper pharyngeal jaw, and the loss of the stomach. These innovations shift the load of food processing entirely onto the pharyngeal teeth and lower pharyngeal jaw (LPJ). Since the LPJ plays such a singular role in food processing, quantifying the diversity of the Cypriniform LPJ may help us understand how this group has diversified and adapted to novel feeding environments. Here we investigate Cypriniform LPJ morphospace occupation in order to determine whether diversity in shape of the LPJ is more closely correlated with function or phylogeny. We utilize geometric morphometric (GM) techniques to build and analyze a geometric morphometric morphospace (GMM) of over 60 genera containing altogether more than 90 species of Cypriniformes. We selected 5 landmarks and 36 semilandmarks along the tooth-bearing face of the LPJ to compare coordinate data between specimens. Landmarks are superimposed and undergo a generalized Procrustes analysis to isolate variance in shape, followed by a principal components analysis to determine major axes of variation. We then compare patterns of shape diversity at the family, subfamily, genus, and species level using models of linear regression. Using our own shape data in combination with trophic information and phylogenetic analyses found in the literature, we are able to quantify and analyze patterns of diversity within the Cypriniform pharyngeal jaw.

PRIMARY PRESENTER

Acacia Ackles

STATUS

Student – Undergraduate

AUTHORS

Acacia Ackles

Joshua D. Storch

L. Patricia Hernandez

RESEARCH MENTOR/ DEPARTMENT CHAIR

L. Patricia Hernandez

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Detection of Exoplanets Using the Transit Method

I conducted differential photometry on a star GSC 3281-0800, a known host to exoplanet HAT-P-32b, using analysis software AstroImageJ. I plotted the measurements from a series of images taken during the transit, via ADU count given from an earth-based digital CCD camera. I was able to establish a definite light curve and learn more about the properties of this exoplanet.

PRIMARY PRESENTER

Dennis Afanasev

STATUS

Student – Undergraduate

AUTHOR

Dennis Afanasev

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sylvain Guiriec

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Can You Really Isolate DNA for PCR in Under 30 Seconds? Yes!

Zou et al. (2017; PLoS Biol., 15(11): e2003916) developed a 30 second nucleic acid purification method from plant tissue and blood for the purposes of PCR. This seemed unlikely, so we decided to test and adapt it for isolation, purification, and analysis of *E. coli* genomic DNA, a pCR4-TOPO plasmid with a *SpTrf* gene, a bacterial artificial chromosome (BAC) clone with a cluster of *SpTrf* genes, and genomic DNA from sea urchin coelomocytes (immune cells) that includes *SpTrf* genes. The *SpTrf* genes are of interest because they are a rapidly diversifying family that encode proteins that bind bacteria and have speculative anti-pathogen activity. Zou et al. (2017) report that Whatman No. 1 filter paper is adequate for binding DNA directly from lysed cells that can be used for PCR without extensive cleaning and purification steps. Preliminary tests were conducted on purified DNA samples of pCR4-TOPO-*SpTrf* and BAC-*SpTrf* to determine whether Whatman #1 paper squares of 4 X 4 mm were capable of binding DNA for PCR. Paper squares held by tweezers were dipped in dilutions of the purified DNA samples, dipped in a wash buffer, and dipped directly into the PCR reaction (complete with all reagents except for the template DNA). Amplification of the *SpTrf* genes was successful. Next, pelleted bacteria with the *SpTrf* clones will be resuspended in lysis buffer and paper squares will be dipped in the lysate, washed, and dipped directly into the PCR reaction. The final test will de conducted on lysates of sea urchin coelomocytes following the paper square protocol and PCR to evaluate the *SpTrf* genes and the *GAPDH* gene control in the genomic DNA. We propose to use this protocol because it is fast, cheap, and will speed up future projects to evaluate the *SpTrf* gene family diversity in a large number of sea urchins.

PRIMARY PRESENTER

Jacob Agronin

STATUS

Student – Undergraduate

AUTHORS

Jacob Agronin

L. Courtney Smith

RESEARCH MENTOR/ DEPARTMENT CHAIR

L. Courtney Smith

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Development and Characterization of Low-Cost, Carbon Dioxide Sensors for Deployment Throughout the Washington Metropolitan Area

The recent increase of carbon dioxide (CO_2) and other greenhouse gas concentrations in our atmosphere is one of the most significant concerns in environmental science. To address the threat of rising CO_2 concentrations, real-time data must be collected for analysis and showcased for public engagement. High-precision optical sensors for these gasses are available, but they are not cost-effective for mapping a large spatial area. Our goal is to build out a network of low-cost sensors that are accurate and precise enough to provide a valuable data tool for accessing carbon emissions from a large, urban area. Sensors developed in our lab (referred to as "LuftSinn" sensors) utilize a non-dispersive infrared (NDIR) sensor for measurement of CO_2 concentrations and are combined with temperature-pressure-humidity sensors. LuftSinn units are enclosed in a weather-proof box powered by a 20 W solar panel that charges an 18 Ah battery. Each LuftSinn unit broadcasts data to a webpage (luftsinn.com) that leverages recent developments in open source GIS tools. In this way, data from sensors can be followed individually or aggregated to provide real-time, spatially-resolved data of CO_2 trends across a broad area. Before these units are deployed in the DC area, they undergo extensive calibration to ensure accuracy and precision of reported CO_2 concentrations. When implementing the unit, three factors must be accounted for: sensor offset, temperature sensitivity, and pressure sensitivity. Each parameter will be corrected through the implementation of experimentally determined calibration curves programmed into the unit's software. These calibration curves are obtained by simultaneous measurements of air samples by the Luftsinn unit and using a high-precision, greenhouse gas analyzer from Los Gatos Research. With this procedures, accuracy and precision are each narrowed from the manufacturer's reported transducer value of 30 ppm down to one percent of ambient levels (4 ppm).

PRIMARY PRESENTER

Esraa Ahmad

STATUS

Student – Graduate

AUTHORS

Esraa Ahmad

D. Michelle Bailey

J. Houston Miller

RESEARCH MENTOR/ DEPARTMENT CHAIR

J. Houston Miller

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Bipedal vs. Terrestrial Signals in the *Australopithecus Afarensis* Fourth Metatarsal

Australopithecus afarensis is a ~3–4 million-years-old hominin whose mosaic morphology causes continuous debates. For example, the morphology of the pedal phalanges are relatively long and curved, resembling African apes, and are seen as arboreal locomotor adaptations. On the other hand, its anklebones and metatarsals are human-like, suggesting striding bipedalism. In 2000, a complete *A. afarensis* fourth metatarsal (AL-333-160) was recovered in Hadar, Ethiopia. This metatarsal presented distinctive modern human features (e.g., torsion, base morphology) supporting the hypothesis that *A. afarensis* exhibited modern human foot arches supporting the hypothesis that this early member of the human lineage was a committed terrestrial biped by 3.2 Ma (Ward et al., 2011 Science).

Building on Ward et al.'s study with a larger and more diverse comparative sample (a 154 specimen increase, including more apes as well as other primates), and using advanced 3D digitization methods, we measured torsion [T], proximal articular surface dorsoplantar-mediolateral ratio [DM], plantar-diaphysis angle [PDA], plantar-base angle [PBA], base-diaphysis angle [BDA], proximal contour ratio [PCR], and lateral cuneiform articular facet presence [CAF], to assess if humans differ from other anthropoids, and if *A. afarensis* is human-like. While humans overall differ from non-human hominoids, they overlap in some variables (PBA, BDA, PCR). In general, AL-333-160 is closest to modern humans, but also with other taxa in all variables. Additionally, the lateral cuneiform articular facet varies in modern humans, and is also present in some apes and Old World monkeys, suggesting that, individually, these features cannot be relied upon when inferring bipedal adaptations from a single fourth metatarsal. Overall shape variation was summarized with a principal component analysis (PCA) in which PC1 (46.42% of the variance) separates most non-human hominoids from humans and Old World monkeys (which largely overlap along PC2), and AL-333-160 falls within the overlapping morphospace region of humans and Old World monkeys. PC1 seems to be driven by high loadings of torsion, the proximal articular surface dorsoplantar-mediolateral ratio, the plantar-diaphysis angle, and the proximal concavity ratio. These results suggest that some functional variables traditionally linked to bipedalism in fossil members of the human lineage could instead represent general terrestrial adaptations.

PRIMARY PRESENTER

Alisha Anaya

STATUS

Student – Undergraduate

AUTHORS

Alisha Anaya

Sergio Almécija

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sergio Almécija

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Ecology of Color Vision in Diademed Sifakas

Color vision variation in primates provides a model system for studying links between ecology, genetics and adaptation. Color vision as the product of molecular evolution is well-understood: a few amino acid changes in the protein-coding region of the X-linked medium/long cone photopigment (X-linked opsin) gene leads to differences in light sensitivity and color distinction. In many primates (e.g. New World monkeys and lemurs), genetic variation at the X-linked opsin gene results in three different types of color vision (full color vision, and two types of color-blindness). However, the selection pressures influencing this variation are unresolved. Differences in diet, habitat and predation pressure have been hypothesized as drivers of this color vision variation between primate species, populations and individuals. Accordingly, this study aims to investigate the relationship between ecology, genetic diversity, and color-vision in primates—specifically focusing on a wild lemur population.

Diademed sifakas (*Propithecus diadema*) of the Tsinjoarivo Classified Forest in eastern Madagascar are diurnal lemurs that live in assorted ecological zones, including semi-pristine and highly fragmented forests; which results in habitats of diverse shade cover, food availability, and anthropogenic intrusions. Social groups at Tsinjoarivo have been monitored through telemetry, behavioral observation, and estimated pedigrees for the past 20 years. Sifakas at Tsinjoarivo also vary in hair pattern and color complexity to a degree not seen in other primate species, which is compelling given that genotyping of 20 individuals from Tsinjoarivo indicates that *P. diadema* individuals vary in color vision capacity.

PRIMARY PRESENTER

Lauren Anderson

STATUS

Student – Undergraduate

AUTHORS

Lauren Anderson

David Frankel

Maanas Nukala

Elizabeth Tapanes

RESEARCH MENTOR/ DEPARTMENT CHAIR

Brenda Bradley

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Investigating the Effects of MID1-RNA Binding on MID1 E3 Ligase Activity

Midline-1 (MID1) is an enzyme that targets proteins for cellular degradation. Two of its domains in particular, Bbox1 and Bbox2, are critical for this function. As part of this function, MID1 targets the proteins alpha 4 and protein phosphatase 2A (PP2A) by catalyzing their ubiquitination (covalent attachment of ubiquitin), leading to their cellular degradation. PP2A in particular is important biologically because it regulates the cell cycle and disruption of its cellular concentration can lead to cell death. Mutations of MID1, including in the B-box domains, results in Opitz syndrome, which is characterized by midline abnormalities such as cleft lip, cleft palate, wide spaced eyes and defects in the brain, heart and genitalia. Furthermore, it was recently shown that MID1 binds to the mutant mRNA of the Huntingtin protein, with a CAG repeat. MID1 stabilizes the mRNA and promotes the production of the mutant protein, which aggregates and leads to neural cell death, causing Huntington's Disease (HD). Data show that the Bbox1 and Bbox2 domains of MID1 bind to the CAG RNA sequence. Since the Bbox domains are important for the ubiquitination activity, I present results showing the effects of the presence of RNA on MID1 ubiquitination activity and substrate targeting.

PRIMARY PRESENTER

Yiorgos Argyros

STATUS

Student – Undergraduate

AUTHOR

Yiorgos Argyros

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michael Massiah

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Multiplying Curves on the Thickened T-Shirt

In 1987 Józef Przytycki introduced Skein Modules as a way to extend the knot polynomials of the 1980's to knots and links in arbitrary 3-manifolds. Since their introduction Skein Modules have become central to the theory of 3-manifolds. In 1997, Charles Frohman and Razvan Gelca gave a nice product-to-sum formula for the Kauffman Bracket Skein Algebra of the torus times the interval. We try to discover a similar formula for the multiplication of curves on the sphere with four holes times the interval.

PRIMARY PRESENTER

Rhea Palak Bakshi

STATUS

Student – Graduate

AUTHORS

Rhea Palak Bakshi

Sujoy Mukherjee

Józef Przytycki

Marithania Silvero

Xiao Wang

RESEARCH MENTOR/ DEPARTMENT CHAIR

Józef Przytycki

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Elucidating a New Binding Reaction Between an E2 Ligase and a RING Fold

Human MID1 protein is an ubiquitin E3 ligase that catalyzes the ubiquitination of protein phosphatase 2A, alpha4 and fused kinase. The B-box1 domain is required for efficient ubiquitination of these protein substrates. Despite not sharing any sequence homology, the B-box1 domain adopts a ββα-RING fold similar to RING- and U-box E3 ligases. Because ligase activity is largely defined by its interaction with the E2 conjugating enzyme, we investigated the interaction of the MID1 B-box1 with the UbcH5a (E2) enzyme, its preferred E2. The NMR binding data reveal that the B-box1 domain binds on a surface that is very close to the active site C85 of the E2 enzyme. Fluorescence binding data reveal the UbcH5a:B-box1 complex is ~3x tighter than complexes reported for E2:RING domains. Using HADDOCK, a calculated model of the UbcH5a:B-box1 complex confirms that the binding surface is different from the interface commonly observed for E2:RING/U-box complexes. These studies reveal a new binding interaction between the UbcH5a E2 enzyme and a RING fold.

PRIMARY PRESENTER

Angela Belic

STATUS

Student – Graduate

AUTHORS

Angela Belic

Michael Massiah

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michael Massiah

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Algorithmic Complexity of Detecting Properties of Groups

The standard definition of a mathematical structure called a group is a non-empty set, with identity, that satisfies the group axioms of closure, associativity, and element inverses. An equivalent characterization is to view a group as all words formed from a non-empty set of letters and their inverses, called generators, reduced according to rules which are specified by a collection of words called relators. This characterization is called a group presentation.

When considering groups from the perspective of presentations it is natural to ask if it is possible to algorithmically decide, from the given generators and relators alone, whether the group has algebraic properties such as commutativity, nilpotence, and others. Historically such questions were first asked about groups with finite presentations by Max Dehn in 1911. In a similar vein we investigate decision problems on the larger family of Markov Properties. Specifically, we focus our attention on the class of groups with recursive presentations, those with sets of generators and relators that are both algorithmically enumerable.

We first prove that Markov properties are not algorithmically decidable from a recursive presentation of group, and turn to measuring the precise degree to which these decision problems are algorithmically unsolvable in the Kleene Arithmetical Hierarchy. For the properties abelian, torsion, nilpotent, having a decidable Word Problem, and others we give exact classifications by using tools from computability theory, group theory, and some interesting examples of wreath products.

PRIMARY PRESENTER

Iva Bilanovic

STATUS

Student – Graduate

AUTHORS

Iva Bilanovic

Jennifer Chubb

Sam Roven

RESEARCH MENTORS/ DEPARTMENT CHAIRS

Valentina Harizanov

Jennifer Chubb

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Annotation of *PlexB* on the Dot Chromosome of *Drosophila Takahashii*

The fruit fly *Drosophila melanogaster* is a model organism for genetics, and its genome has been well-researched and fully mapped. The dot chromosome of *D. melanogaster*, and of the *Drosophila* genus in general, is of particular interest, as it exhibits both heterochromatic and euchromatic properties. The Genomic Education Partnership (GEP) has enlisted the help of undergraduate students across the country to annotate genes on the dot chromosome of lesser known *Drosophila* species in order to study how the dot chromosome is evolving. For this specific project, I annotated two isoforms of the *PlexB* gene from *D. takahashii* and compared them to the *D. melanogaster* genome. *PlexB* is found on the dot chromosome. It is a transmembrane receptor for ligands, regulating cellular processes and guiding axons. Through the use of the UCSC Genome Browser, as well as Flybase and NCBI BLAST, I was able to determine the coordinates for the exons on the *D. melanogaster* genome that corresponded to the *PlexB* gene. The coordinates of the start and end of the exons were submitted to a gene model checker and confirmed. The results showed that between the two sequences there was 90.4% identity and 94.3% similarity, with gaps comprising 1.9%. The conservation between *PlexB* in *D. takahashii* and *D. melanogaster* found in this report should be expected, as it is a vital gene for cellular function. Further research can now be conducted by GEP on the structure and conservation of the dot chromosome in the *Drosophila* genus.

PRIMARY PRESENTER

Olivia Cantello

STATUS

Student – Undergraduate

AUTHOR

Olivia Cantello

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Monte Carlo Simulation of Spin-Polarized Electron Emission from GaAs Photocathodes Activated to Negative Electron Affinity

Due to the recent research activities at Thomas Jefferson National Accelerator Facility and proposed Electron-Ion Collider designated to study nucleon spin structure, parity-violating mechanisms, and other spin-dependent phenomena, demand for the highly-efficient spin-polarized electron sources has been dramatically increased. Due to a set of key features, GaAs and GaAs-based photocathodes activated to negative electron affinity (NEA) are considered to be the main candidates to produce polarized electron beams of high intensities for advanced particle-physics experiments. Effective polarized electron sources should have high quantum efficiency (QE) and high polarization, low emittance, prominent response time, and long operational time. Characteristically, the fabrication methods and techniques commonly used to increase QE lead to the depolarization of electrons emitted from GaAs cathodes and, vice versa, highly-polarized electron sources have low QE. Deep understanding of momentum- and spin-relaxation mechanisms in the bulk and at the surface of the material is required in order to develop a highly-efficient polarized electron source. We employ the Monte Carlo techniques to study in detail the photo-absorption, spin-polarized electron transport, and tunneling of electrons through the potential barrier at the surface of p-type NEA GaAs photocathodes. In particular, we study the response of photoemission curves to different income parameters, such as photoexcitation energy, doping concentration, and the electron affinity level.

PRIMARY PRESENTER

Oksana Chubenko

STATUS

Student – Graduate

AUTHORS

Oksana Chubenko

Andrei Afanasev

RESEARCH MENTOR/ DEPARTMENT CHAIR

Andrei Afanasev

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Secrets in Master Filtering: Using μCT and 3D PIV to Model Silver Carp Filter Feeding

Invasive Silver carp are thriving in eutrophic environments in the United States due to efficient filter-feeding mechanisms. Like many filter-feeding fishes, Silver carp utilize modified gill rakers to enhance filtering efficiency; however, unlike other fishes, Silver carp gill rakers are fused together to form highly porous, channeled filtering plates. This filtering morphology captures a broad range of particles ranging in size from 4–80 μm, which may explain how this species can outcompete other fishes. While descriptive studies exist no work has yet described the mechanism behind Silver carp filtration. Here we investigate the hydrodynamics of Silver carp filter feeding using volumetric Particle Image Velocimetry (3D PIV). Fixed gill rakers and 3D models (based on 10μm and 28μm μCT scans of adult Silver carp and its sister species Bighead carp) were placed in a recirculating flow tank with water flowing across the model in both the anteroposterior and posteroanterior directions. Neutrally-buoyant 50μm nominal size particles were illuminated by a 50mJ-100Hz Nd:YAG pulse laser focused into a 14cm x 14cm x 14cm volume using an optic and mirror system, tracked and processed using V3V software, and resulting vector information was analysed in Tecplot. Using 3D PIV, we tracked particle and fluid interaction from the surface of the gill raker through the various sized pores along the filter. Based on results from these multiple PIV studies and morphological analyses, we find that the morphology on the outer face of the gill raker plates quickly organizes flow across the entirety of the surface. This transition from turbulent to laminar flow initiates strong vorticular flow, accounting for particle capture and retention.

PRIMARY PRESENTER

Karly E. Cohen

STATUS

Student – Graduate

AUTHORS

Karly E. Cohen

L. Patricia Hernandez

Callie H. Crawford

Brooke E. Flammang

RESEARCH MENTOR/ DEPARTMENT CHAIR

L. Patricia Hernandez

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Investigating Stabilizing π–π Interactions in Acetylcholinesterase that Promote Neurotoxic Effects of Aromatic Organophosphate Flame Retardants

Chemicals with known toxic effects often remain in-use due to lack of similarly efficacious compounds. However, recent advances in computational and mechanistic toxicology as well as computational tools used in drug discovery suggest one could rationally redesign existing (toxic) chemicals in commerce to both lessen their biological activity while preserving functional efficacy. The Kostal Research Groups has been pursuing this goal on organophosphates, a class of flame-retarding chemicals, pesticides and hydraulic fluids that is linked to neurotoxicity via inhibition of acetylcholinesterase (AChE).

At the neuromuscular junction, the release of acetylcholine is responsible for muscular contraction; this postsynaptic response is concentration dependent. Acetylcholinesterases quickly regulate acetylcholine levels via ester-hydrolysis to acetate and choline, which are transported back into the nerve to be recycled. Many organophosphates are known to inhibit AChE via phosphorylation of the active site's serine. The result is excess neurotransmitter accumulation, which overstimulates and fatigues the receptors, leading to neuromuscular paralysis. Human AChE has several aromatic amino acids in its phosphorylation binding pocket that are instrumental in stabilizing aromatic organophosphate substrates, such as the phenyl groups on the flame retardant triphenyl phosphate (TPP). These π–π interactions lower the system's energy by sharing delocalized electron density, which increases binding affinity, thereby promoting enzyme inhibition and boosting the xenobiotic's toxic effects.

To minimize favorable π–π interactions within AChE, one must understand how the parts affect the whole. Herein, we constructed a simplified dimer system, with mono-substituted benzenes in various orientations. Expanding on previously reported benchmarking studies, we have conducted multidimensional scans of the systems' intermolecular degrees of freedom to explore the energetics and geometries of their free energy surfaces. Several methods were tested and compared in performance to high-level CCSD(T)/aug-cc-pVTZ calculations, considering both relative accuracy and computational demands. We found that the (previously untested) hybrid DFT approach, M06-L/6-311++G(d,p), yields accuracy comparable to high-level *ab initio* methods at fractional cost. Furthermore, a classical force field method employing quantum charges, OPLS-AA/CM1A, was nearly as accurate at negligible computational cost. However, more rigorous testing showed that while OPLS-AA/CM1A is quite accurate, it does not always reproduce the entire potential energy surface correctly. Our results suggest that an empirical correction system could be developed to increase accuracy of OPLS-AA/CM1A, which could in turn be used in the context of statistical free energy perturbation calculations, employed in our group to study relative binding affinities of AChE inhibitors.

PRIMARY PRESENTER

Eric Corcoran

STATUS

Student – Graduate

AUTHORS

Eric Corcoran

Jakub Kostal

RESEARCH MENTOR/ DEPARTMENT CHAIR

Jakub Kostal

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Annotation of Rad23 on the Dot Chromosome of *Drosophila Takahashii*

A gene within raw sequence data from the dot chromosome of the fruit fly *Drosophila takahashii* was analyzed and annotated. This project was undertaken as a part of the Genomics Education Partnership (GEP), through which undergraduates across the country are collaborating to sequence and annotate the dot chromosomes of several *Drosophila* species. This dot chromosome, also known as the fourth chromosome or F element, is of interest since there are a normal amount of genes within the chromosome and these genes are normally expressed despite being heterochromatic, where one would expect transcription to be suppressed. By gaining understanding of this phenomenon through comparing *Drosophila* species, aspects of gene regulation may be better understood. The gene analyzed was located within contig22, a DNA sequence compiled from overlapping DNA sequence reads. The gene's analysis and annotation was aided through comparison of its ortholog Rad23, which in *melanogaster* is involved in DNA repair and ubiquitin pathways and is highly expressed in larval Malpighian tubules and adult ovaries, found in the dot chromosome in *D. melanogaster*. This comparison was aided by accessing FlyBase resources and blasting known ortholog *melanogaster* sequences against contig22 confirming the location of Rad23 on contig22. The alignment of RNAseq data from both embryonic and adult *D. takahashii*, demonstrating which sequences were expressed in male and female *takahashii* throughout their development, provided in the genome browser confirmed the predicted orthology and narrowed down the search of possible splice sites. Using the genome browser, possible splice sites were selected and confirmed in the gene model checker. The gene model checker revealed significant divergence between the annotated gene within contig22 and its ortholog Rad23 in D. *melanogaster* having an identity of 77.3% (326/422 codons), a similarity of 84.4% (356/422 codons), and gaps spanning only 2.1% of the sequence (9/422 codons). This lack of conservation shows that the genes have diverged a significant degree. The mechanism for this divergence may be relaxed selection or differing function between *D. takahashii* and *D. melanogaster*.

PRIMARY PRESENTER

Olaf Corning

STATUS

Student – Undergraduate

AUTHORS

Olaf Corning

Mollie Manier

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Genome Annotation of *Thd1-PB* of *Drosophila Takahashii*

The gene *Thd1* is found on the small fourth chromosome, also called the "dot" chromosome, in *Drosophila melanogaster*. What makes this chromosome so unique is its heterochromatic, or tightly packed, nature which should repress transcription. Instead, scientists found that although the chromosome is found in its condensed form, it is still replicated late in the S phase and shows no signs of genetic recombination. This puzzling characteristic, along with *D. melanogaster's* extensive genetic and genomic resources, led the Genome Education Partnership (GEP) to initiate further research into the evolution of the "dot" chromosome. In Genetics Laboratory BISC 2208, I annotated the *Thd1* gene on contig 33 of the *D. takahashii* dot chromosome. There were three isoforms, the one in which I chose for my project was *Thd1-PB*. We used FlyBase BLAST and the Gene Record Finder in order to narrow down the acceptor and donor sites of the five exons seen in the *Thd1-PB* isoform. Using the UCSC Genome Browser we identified the exact coordinates of each exon and intron site and verified these results under the Gene Model Checker. The results showed that 72.5% of the sequence matched the *Thd1* gene in *D. melanogaster* reference genome, and there was 81.2% similarity. The percentage that did not match perfectly to the sequence is probably due to insertions and deletions seen throughout evolution. This information is useful in helping predict certain functions of this gene. For example, scientists believe *Thd1* might play a major role in DNA repair. However, with a function so vital to cells, scientists believe this gene would have much higher conservation. Further experimentation will have to be conducted to explain these results.

PRIMARY PRESENTER

Madison Dixon

STATUS

Student – Undergraduate

AUTHOR

Madison Dixon

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Sleeping Monster: NuSTAR Observations of SGR 1806–20, 11 Years After the Giant Flare

Neutron stars allow us to study matter under extreme conditions of density, gravity, and magnetic field strength beyond what is possible experimentally. Magnetars represent the most extreme version of Neutron Stars and have the strongest measured dipole magnetic fields – up to 10^{15} Gauss. They are the most variable sources among isolated neutron stars. On time-scales of milliseconds, they show a very unique bursting behavior. Following these bursting episodes, they go into outburst where their X-ray flux increases by as many as three orders of magnitude, and decays on months to years' time-scales.

Here, we will present our analysis of 4 X-ray observations of SGR 1806-20, the Magnetar with the strongest measured Magnetic field in the universe, taken from April 2015 until April 2016, more than 11 years after its last major bursting episode. We will show the status of the spectral and flux evolution of the source since previous observations taken in 2011 still showed recovery towards quiescence. Finally, we will compare our results to other Magnetar outbursts, placing the source in context within the whole family.

PRIMARY PRESENTER

Sophia Donovan

STATUS

Student – Undergraduate

AUTHORS

Sophia Donovan

George Younes

Chryssa Kouveliotou

RESEARCH MENTOR/ DEPARTMENT CHAIR

George Younes

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Mass Spectrometry Imaging of Neutral Lipid Species by Laser Desorption Ionization from Silicon Nanopost Arrays and MALDI

Mass spectrometry imaging (MSI) uniquely allows for the simultaneous detection and spatial mapping of a wide range of biomolecules. Matrix-assisted laser desorption ionization (MALDI) is a powerful and well-established MSI technique; however, MALDI imaging of neutral lipid species is difficult due to low ionization efficiency and ion fragmentation. Here, we utilize matrix-free laser desorption ionization (LDI) from silicon nanopost arrays (NAPA) as an MSI platform with minimized matrix interferences and unique substrate properties. In this contribution we compare LDI from NAPA and MALDI for MSI and show that NAPA-MSI is a complementary technique to MALDI-MSI with improved chemical coverage of neutral lipids from biological tissue sections including mouse brain and lung, and human skin. Initially, tissue samples were embedded in 2.5% carboxymethylcellulose (CMC) and stored at -80 °C. For analysis, approximately 10 µm thin tissue sections were cryosectioned at -22 °C, and immediately thaw-mounted onto a glass slide for MALDI, or an imaging chip for NAPA. Briefly, NAPA imaging chips were fabricated from high conductivity silicon wafers by deep UV projection lithography. For MALDI experiments, 2,5-dihydroxybenzoic acid (DHB) solution (50 mg/mL in 60% methanol) was spray coated onto sample slides using a commercial airbrush. Approximately 10–14 coatings were applied with 10 s spray durations followed by 30 s drying periods. All samples were vacuum dried before analysis. Finally, all analysis was performed in positive ion mode using a MALDI LTQ Orbitrap XL mass spectrometer. Notably, cholesterol was detected in the brain at higher intensities in NAPA spectra when compared to MALDI. Moreover, spectra obtained from coronal mouse lung sections indicated lipid-rich regions; in particular, NAPA spectra were characterized by increased triacylglycerol (TAG) signal intensity, whereas phosphatidylcholine (PC) lipids dominated the MALDI spectra. Similarly, both platforms revealed high ion intensities from lipids in the epidermis of human skin samples. Several lipids, including a peak at *m/z* 879.741 assigned as a TAG, were found to routinely produce much higher signal intensities from NAPA. Ion intensities from the dermal skin layer were lower in both MALDI-MSI and NAPA-LDI-MSI. Importantly, MALDI and NAPA were observed to provide complementary coverage of lipid species from mouse lung and human skin sections. Specifically, in the MALDI spectra TAG species were often masked by highly abundant PC lipids. Conversely, TAGs were found to dominate the NAPA spectra, thereby enabling more effective spatial mapping of these neutral lipids in biological tissues.

PRIMARY PRESENTER

Jacqueline E. Dyer

STATUS

Student – Undergraduate

AUTHORS

Jacqueline E. Dyer

Jarod A. Fincher

Nicholas J. Morris

Matthew J. Powell

Derek Jones

Victoria K. Shanmugam

Sridevi Yadavilli

Javad Nazarian

Russell K. Pirlo

Akos Vertes

RESEARCH MENTOR/ DEPARTMENT CHAIR

Akos Vertes

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Annotating the *myo* Gene on the *D. Takahashii* Dot Chromosome

Drosophila melanogaster has been widely studied and provides scientists with a fully mapped genome and extensive information for genetic studies. There is a small fourth chromosome, also called the "dot chromosome" on *D. melanogaster* that is composed of tightly wound DNA regions which are transcriptionally active despite their condensed form. This chromosome is an interesting case study for genome evolution and has spurred the interest of the Genome Education Partnership (GEP), a national educational and research collaborative studying genome evolution within the *Drosophila* lineage. In BISC 2208 Genetics Laboratory, I compared the *myo* gene found on the dot chromosome of *D. melanogaster* with that of a related species, *D. takahashii*. Using data from the UCSC Genome Browser and BLAST technology, I compared the sequence of the *myo* gene in *D. melanogaster* to the analogous contig in *D. takahashii* and annotated the expected intronic and exonic regions, as well as the start and stop sites. While the function of the *myo* gene has not been experimentally found, FlyBase predictions estimate it to be related to growth factors and their transformation for receptor binding and cytokine activity. The *myo* gene showed an overall similarity of 81.8% between the two species, showing that there has been some evolution of the gene between *D. melanogaster* and *D. takahashii*. While there is still an overall conservation of gene structure, this is a lower percentage than expected because genes containing important cellular function are typically widely conserved between lineages. Overall, the annotation of different genes on the dot chromosome and their evolution between species will provide valuable insight for GEP partners as they continue to explore the unique patterns on the *Drosophila* dot chromosome.

PRIMARY PRESENTER

Audra Fain

STATUS

Student – Undergraduate

AUTHOR

Audra Fain

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Complexes with Interesting Magnetic Properties: Unusual Metal-Ligand Coordination

Trispyrazolylborate complexes are widely studied for their magnetic properties as well as their applications in a range of fields including catalysis and material science. In particular, iron and cobalt complexes have shown bistability: the molecule can exist in two different (meta)stable magnetic states, and switch between the two under the influence of various stimuli such as temperature. In order to allow covalent integration of tripyrazolyl complexes into materials, a functionalization of the ligand backbone is required. For that purpose, we are targeting two particularly versatile functional groups: carboxylic acids and amines.

In the course of the synthesis of ethyl-4-pyrazolecarboxylate, a precursor for carboxylate-functionalized trispyrazolylborate ligands, an unexpected side reaction produced a dimeric compound with unusual properties. We optimized the reaction to favor the production of the dimer and, prompted by the promise of interesting magnetic properties, tested its reactivity as an organic ligand by coordination with various metal cations. Our most recent results suggest that the dimer reacts with cobalt chloride to produce a crystalline material with a noteworthy 1:5 metal to ligand ratio.

Nitro-functionalized derivatives were chosen as intermediates in the synthetic route for amine-functionalized trispyrazolylborates. A 1-nitropyrazole derivative is first synthesized and then heated to become the 3-nitro analogue. Exchange of this compound into unsubstituted trispyrazolylborate and subsequent coordination to a metal ion allows the formation of an asymmetric, mono-substituted complex. After reduction to the amine, we obtain the target complex, a monoamine tripyrazolylborate complex suitable for terminal functionalization of a variety of carboxylic acid bearing substrates, including oxidized carbon nanotubes.

PRIMARY PRESENTER

Natalie Falco

STATUS

Student – Undergraduate

AUTHORS

Natalie Falco

Colten Eberhard

Chenyang Ma

Claire Besson

RESEARCH MENTOR/ DEPARTMENT CHAIR

Claire Besson

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Studying the Role of Novel Patient Mutations in Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is a group of neurodevelopmental disorders characterized by social deficits, repetitive behaviors and restricted interests that affects around 1 in 68 children and is seen individuals of all races, ethnicities, and socioeconomic levels. ASD has been shown to be caused by a variety of genetic mutations, including mutations in the CC2D1A gene. Previous work in the lab show that CC2D1A protein has a role in intellectual development, and mutations can cause ASD, intellectual disability, seizures and aggressive behaviors. The goal of my project is to study the effect of multiple novel CC2D1A mutations that were identified in children affected with neurodevelopmental delay and ASD.

CC2D1A has been found to be involved in several intracellular signaling pathways which are critical for neuronal differentiation and function, and I will ask how the patient mutations affect subcellular protein localization and intracellular signaling. The project started by generating the Wild-Type (WT) clone for the human CC2D1A sequence, and then inserting the required mutation into the plasmid using site-directed mutagenesis techniques. Once the patient mutations were generated, human embryonic kidney (HEK)293 cells were transfected with the different mutations to induce over-expression of the CC2D1A protein. The transfected cells were used for immunofluorescence staining against markers of different intracellular organelles (endosomes, lysosomes, mitochondria), to compare the effects of the mutant over-expression to the wild-type over-expression. The transfected cells were also lysed and used for western blot assays, to determine activation of the AKT pathway within the cells. The induced over-expression of WT CC2D1A causes specific morphological changes to intracellular organelles and prompts phosphorylation and hyperactivation of AKT. If the mutations do cause a change of protein function, then the transfected cells should not present with the same morphology, or demonstrate the same activation of the AKT pathway. If successful, multiple assays will be developed to test whether CC2D1A missense mutations are responsible for the observed phenotypes, and this project can directly inform patient family on whether these mutations are causal of the observed clinical findings.

PRIMARY PRESENTER

Edward Farrow

STATUS

Student – Undergraduate

AUTHORS

Edward Farrow

Tyler Spivey

Pablo Munoz Llancao

M. Chiara Manzini

RESEARCH MENTOR/ DEPARTMENT CHAIR

M. Chiara Manzini

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Morphological Variation in the Pelvis of Gorilla Subspecies May Not Track Ecomorphological Predictions

Gorillas habitats range in elevation from zero to 3,850 meters above sea level. Populations living at the highest elevations tend to be less arboreal than lowland populations. These habitat-specific behaviors make gorillas a unique model to study relationships between locomotion and skeletal morphology in closely related taxa. This relationship has yet to be explored in the gorilla pelvis. We evaluate whether pelvic morphology shows clinal variation from lowland to highland habitats within *Gorilla*. Using 3D geometric morphometrics and principal components (PC) analysis, we analyzed pelvic shape variation across three gorilla subspecies: western lowland gorillas (*G. gorilla gorilla*), mountain gorillas (*G. beringei beringei*), and highland and lowland Grauer's gorillas (*G. b. graueri*). Given the relationship between elevation and locomotion, we expected similarities between highland *G. b. graueri* and G. *b. beringei* and between lowland *G. b. graueri* and *G. g. gorilla*. In particular, we expected differences in the ilium, where several muscles implicated in climbing behavior attach, including the latissimus dorsi, quadratus lumborum, and gluteal muscles. PC1 suggests differences between *G. gorilla* and *G. beringei* in the lateral margin of the ilium, size and shape of the obturator foramen, and pubis orientation. Along PC2, male *G. b. beringei* are distinct in ilium orientation. Highland *G. b. graueri* and *G. b. beringei* occupy opposite ends of PC2, suggesting that habitat-specific behaviors are poor predictors of pelvic morphology in gorillas. Future work will increase sample sizes to better define ranges of variation and test for a relationship between locality elevation and pelvic shape.

PRIMARY PRESENTER

Lawrence M. Fatica

STATUS

Student – Graduate

AUTHORS

Lawrence M. Fatica

Ashley S. Hammond

Shannon C. McFarlin

Sergio Almécija

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sergio Almécija

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Time Resolved Spectral Fit of the Exceptionally Luminous GRB 130427A

Gamma-ray bursts (GRB) represent the most energetic electromagnetic events to be observed in the universe. Additionally, due to the extremely energetic events required to produce a burst, GRBs are extremely rare. To more accurately understand these intense astronomical events, one of the most energetic pulses ever recorded, GRB 130427A, was spectrographically analyzed. GRB 130427A had an extremely high-energy photon (95 GeV), the longest γ-ray duration ever recorded (20 hours), an extremely large fluence, and was one of the most intense isotropic events released from a GRB. In order to accurately obtain the best-fit parameters for the burst chosen, spectral data was obtained through the archives supported by the Fermi Gamma-ray Space Telescope at NASA Goddard Space Flight Center. Research was then completed via the RFIT software package which effectively allows for user source selection at specific background time intervals corresponding to a detector response matrix. With focus on the well-isolated initial pulse of 2.5s, multiple time resolved spectral analyses of the initial luminosity, spectral peak, and afterglow indicated a strong correlation with Band and Comptonized behavior. This observation is significant as it allows for a greater understand of the potential gamma-ray burst progenitor and the physical processes required to emit the observed radiation.

PRIMARY PRESENTER

Hunter Garbacz

STATUS

Student – Undergraduate

AUTHOR

Hunter Garbacz

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sylvain Guiriec

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Examination of the Electronic Structure of Oxygen-Containing PAH Dimers and Trimers

Soot enters the atmosphere as a byproduct of combustion and as "black carbon" is the second largest contributor to global warming, only behind carbon dioxide in importance. The interaction of oxygen with polynuclear aromatic hydrocarbons (PAH) composing soot can occur both in flames and during later atmospheric oxidation. Past experimental measurements of PAH in soot samples collected either immediately after combustion, from the atmosphere, or in a flame show a variety of oxygen moieties within the PAH structures. This study investigated the electronic structure of oxygen-containing PAH to gain insight into their interaction with light both to better interpret spectroscopic measurements and to recognize the role of oxygen-containing PAH in atmospheric radiative forcing. Density functional theory (DFT) was used to determine the electronic structure of oxygen-containing PAH and their parent PAH molecules. Our research has shown that oxygen in hydroxyl and ether moieties on PAH showed little change to the HOMO-LUMO gap (HLG), whereas ketones and aldehydes show a HLG decrease of 0.5 eV. The effect is enhanced when more than one ketone is present on a PAH molecule and further enhanced in subsequent dehydrogenation to a quinone-like structure. The presence of a ketone-containing PAH in a dimer and trimer will substantially lower the HLG of the PAH stack. This may have a significant effect in the interaction of atmospheric soot with solar radiation.

PRIMARY PRESENTER

Jennifer Giaccai

STATUS

Student – Graduate

AUTHORS

Jennifer Giaccai

J. Houston Miller

RESEARCH MENTOR/ DEPARTMENT CHAIR

J. Houston Miller

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Computational Approaches to Analyze Next-Generation Sequencing Generated Microhaplotype Data for Exceptional Resolution in Forensic Applications

One of the biggest problems facing DNA identification efforts in the forensic science community is mixture deconvolution. Attempts to rectify this increasingly prevalent situation have been made by robabilistic genotyping software and using next generation sequencing (NGS) to sequence short tandem repeats (STRs). However, sequencing STRs does not always help, especially with imbalances mixtures where minor contributor alleles are in the range of PCR artifacts (stutter peaks) of the major. Moreover, a single complex STR allele can generate multiple types of stutter peaks increasing the complexity of the interpretation. Microhaplotypes (MHs), typed on NGS platforms, can enhance mixture deconvolutions and provide increased discrimination power and ancestry predictions. MHs are loci of two or more single nucleotide polymorphisms (SNPs) within a short distance from each other (<300 nucleotides i.e. 'micro') with three or more allelic combinations ('haplotypes'). Unlike STRs, MHs have a low mutation rate and show no PCR stutter, and using NGS, phasing information between the SNPs can be attained. The amount of data generated by a single NGS run can be upwards of a million times greater (1 GB to 1 TB worth of data) compared to about 1 MB of data generated by a single Sanger sequencing run. The forensic science community is relatively new to working with data on this scale, which requires new computational tools. We have developed a tool to assist the forensic science community with MH analyses. The tool sifts through the sequencing reads, identifies the MH locations across the genome, and interprets the allelic combinations, Raw sequencing reads from Illumina or filtered Ion S5 data are the inputs, and QA/QC is performed. Based on read sequence, read coverage and chromosome position, each MH is identified. The genotype of each SNP in each MH is determined, and a haplotype is characterized by phasing the SNPs together. The haplotypes for each MH are represented in a plot, similar to interpretation of an STR electropherogram, where the x-axis is a haplotype sequence and the yaxis is a read depth coverage. A read ratio between sister haplotypes can be determined, comparable to conventional STR data, and contributors in a mixed sample can be separated. In conjunction with STR data, the tool produces court ready documents that depict the genetic profile of both STRs (if included in analysis) and MH for each contributor. Along with the development of a tool to process NGS generated MH data, additional SNPs within each MHs have been identified. Identifying other possible SNPs to include within a MH increases the discrimination power of the marker. Allele frequencies of identified SNPs will be determined on varying populations, including Caucasian, African American, and Hispanic, to provide statistical analysis such as the random match probability. The development of this computational analysis tool and identifying additional SNPs within each MH strengthens the foundation of MH for use in criminal casework and helps to combat the problem of mixture deconvolution.

PRIMARY PRESENTER

Keylie Gibson

STATUS

Student – Graduate

AUTHORS

Keylie Gibson

Fabio Oldoni

Daniele Podini

Keith Crandall

RESEARCH MENTOR/ DEPARTMENT CHAIR

Keith Crandall

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Swift/XRT Deep Galactic Plane Survey

The Swift Deep Galactic Plane Survey (DGPS) utilizes the X-ray Telescope (XRT; 0.3-10 keV) in the first deep, homogeneous and systematic search for magnetars, High-Mass X-ray Binaries (HMXBs), and transients in the Milky Way. Over two years we will survey 40 sq. deg. in the two regions where the galactic bar meets the Scutum and Perseus arms (10° < | galactic longitude (l) |< 30° and | galactic latitude (b) | < 0.5°) in 366 overlapping 5ks tiles. The survey will be complete to luminosities of L=1.0 x 10^34 erg s^-1 and relies on multi-wavelength archival and follow up data to determine the spectral and temporal properties of new or variable sources, and thereby identify their nature. The goal of this survey is to better establish the source populations of compact stellar systems by increasing their numbers for statistical studies. We will study massive star evolution, the diffuse galactic ridge emission, and potentially, the Galactic star formation. Here we present some of our first results.

PRIMARY PRESENTER

Nicholas Gorgone

STATUS

Student – Graduate

AUTHOR

Nicholas Gorgone

RESEARCH MENTOR/ DEPARTMENT CHAIR

Chryssa Kouveliotou

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Identification and Characterization of Candidate Infection Genes from the Entomopathogenic Nematode *Heterorhabditis Bacteriophora*

Nematodes are among the most abundant organisms on the planet, occupying both free-living and parasitic niches. Free-living nematode biology is well-understood due to extensive research on the model organism *Caenorhabditis elegans*. However, despite causing considerable damage to agriculture, livestock, and human health, the infective processes of parasitic nematodes are poorly understood at the molecular level. The obligate requirement for a vertebrate host, which makes life cycle maintenance costly and access to parasitic stages difficult, is the primary reason for the poor understanding of infection mechanisms. Furthermore, *C. elegans* does not provide information on parasite-host interactions due to its free-living life cycle. Recently, the entomopathogenic nematode *Heterorhabditis bacteriophora* has been developed as a tractable model for parasitic nematode infection. *H. bacteriophora* infects its insect host as a free-living infective juvenile (IJ) and quickly kills it with the aid of a gut-dwelling symbiotic bacterium, *Photorhabdus luminescens*. To investigate the contribution of the nematode to the infection, the transcriptional response of IJs during the early stages of infection was profiled. RNA-seq was performed using total RNA extracted from *H. bacteriophora* soaked in the hemolymph of the tobacco hornworm, *Manduca sexta*. Comparative analysis with untreated controls identified a subset of differentially expressed genes that were orthologous to vertebrate parasitic nematodes, but not to *C. elegans*. Four genes were selected for further analysis: *Hba_07292, Hba-cpf-1, Hba-dpy-13*, and *Hba-pcp-1*. These genes are predicted to code for a nematode collagen protein (*Hba-dpy-13*), a UDP-glycosyltransferase (*Hba_07292*), and peptidases (*Hba-cpf-1* and *Hba-pcp-1*). Rapid amplification of cDNA ends (RACE) was used to obtain the full-length coding sequences of the genes of interest, which were subsequently cloned into bacterial expression vectors for protein expression. Following induction of *Hba-pcp-1*, poly-histidine tagged protein was purified by affinity purification. Further functional characterization of *Hba-PCP-1* and other candidate proteins will increase our knowledge of parasite-host interactions and aid in the future development of methods to control parasitic nematode infections. The research provided here will act as a scaffold for future investigation of nematode infection mechanisms.

PRIMARY PRESENTER

Olivia Granger

STATUS

Student – Undergraduate

AUTHORS

Olivia Granger

Jonathan Vadnal

John Hawdon

RESEARCH MENTOR/ DEPARTMENT CHAIR

John Hawdon

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Developing an Automatic Pipeline to Improve the Productivity in GRB Analysis

Gamma Ray Bursts, which are extremely energetic explosions that have been observed in distant galaxies, could be one of our most reliable sources to study the most appealing secrets of the universe. However, the data we receive from the instruments right after the detection of GRB is inaccurate with the errors brought by the instruments. Therefore, our goal is to design a pipeline automatically applying the calibration into the observed data set, which provides the scientist with the correct data once the GRB is detected. Technically speaking, we are hoping to establish a microservice using different programming languages, such as python, golang or c++, to reach the best performance level.

PRIMARY PRESENTER

Zekun He

STATUS

Student – Undergraduate

CO-PRESENTER

Jeff Schulthies

AUTHOR

Zekun He

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sylvain Guiriec

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Assessing CRISPR Mutagenesis Efficiency Using Mosaic Embryos and Fragment Length Analysis

The early insect embryo is a multinucleated cell, or syncytium, which has yet to undergo cellularization (the formation of cell membranes). Injection of CRISPR reagents at this stage thus allows editing of many nuclei, rather than just one. However, not all nuclei of the syncytium are edited, yielding an organism whose body is a mosaic of CRISPR-edited and unedited DNA. Using CRISPR Somatic Tissue Activity Test (CRISPR-STAT), a PCR-based method for analyzing sgRNA efficiency at a particular target site, the activity of specific CRISPR/sgRNA combinations can be studied and the results of gene editing can be examined at up to single base-pair changes. We are assessing the extent to which CRISPR-STAT can be used to quantify the CRISPR activity of any sgRNA at a given target. This methodological work could pave the way to the optimization of CRISPR protocols in insect embryos and yield a better understanding of mosaicism, so as to maximize the number of edited nuclei, producing mosaic animals with a greater proportion of the body exhibiting the edited phenotype.

PRIMARY PRESENTER

Jonah Heller

STATUS

Student – Undergraduate

AUTHORS

Jonah Heller

Arnaud Martin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Arnaud Martin

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Uncovering Ligand-Receptors Interactions in Butterfly Wings: How *WntA* and *Frizzled2* Work Together to Create Complex Patterns

Lepidoptera wings are a promising model system for the study of the genetic basis for pattern formation. Previous research on the non-traditional model organism *Vanessa cardui* has shown how CRISPR/CAS9 mediated mutagenesis can reveal how a single gene, i.e. *WntA*, is responsible for complex morphological patterning. Moreover, the *WntA* signaling ligand gene has been shown to have an array of different phenotypic effects across a number of butterfly species. However, no insights on the receptor gene for this signaling molecule have been formally established for the *Vanessa cardui*, commonly known as the Painted Lady butterfly. The scientific literature suggests that there are a variety of developmental processes that require a combination of *Wnt* ligands and receptors to achieve complex results. Here, we attempt to elucidate the color patterning roles of a *Frizzled* family receptor frizzled-2 (*fz2*). In this project, we produced gene knockouts of *fz2* and examined the genotypic-phenotypic contrast and/or similarities to wild types, as well as *WntA* mutants. The use of imaging and statistical analysis of the areas of the *fz2* mutant's eyespots, chevrons, as well as other regions provide a more quantitative approach to the data. This information will be important for highlighting the major and/or subtle differences between wing patterning in *WntA* and *fz2* mutants. The results of this study support how CRISPR/CAS9 continues to be feasible genetic editing technique in Lepidoptera. Ultimately, this project provides a further understanding of the evolutionary and developmental characteristics of butterfly wing formation.

PRIMARY PRESENTER

José Hermina

STATUS

Student – Undergraduate

AUTHORS

José Hermina

Joseph Hanly

Teomie Rivera Miranda

Chris Day

Arnaud Martin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Arnaud Martin

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Photorhabus Asymbiotica Quorum-Sensing Gene *PauR* May Also Participate in Insect Host Cell Sensing

PRIMARY PRESENTER

Christa Heryanto

STATUS

Staff

AUTHORS

Christa Heryanto

Shreya Wadehra

Ioannis Eleftherianos

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ioannis Eleftherianos

RATIONALE

Photorhabdus asymbiotica (Pa) is a Gram-negative bacterial pathogen that efficiently infects both insects and humans (skin ulcer). Apart from apoptosis induction and septicemia by variety of toxin effectors, quorum sensing/interbacterial communication mediated by *PauR* gene is yet another mechanism recently linked to its virulence. To thrive in either host, *Pa* regulates its gene expression leading to metabolic shift between 30°C (insect) and 37°C (human). This project attempts to explore the involvement of *PauR* in *P. asymbiotica* pathogenicity. Here, we focus on the effect of *Pa* growing temperatures on the *PauR* gene expression in the presence or absence of *Drosophila melanogaster* S2 cells.

METHODS

Estimation of S2 cell viability is aimed at confirming the kill efficiency of *Pa* grown at 30°C and 37°C. We firstly seeded 12-well plate with S2 cells and challenged them with 30°C-*Pa* or 37°C-*Pa* the following day. All incubation after infection was at 30°C. We measured S2 cell viability by Trypan Blue counting and determined the time points at which relative viability reaches 90%, 50%, and 10%. qRT-PCR was subsequently performed to estimate *PauR* gene expression. We also measured the level of *pau00087*, a *Pa* gene with putative role in temperature and environment sensing, to contrast the profile of the quorum sensing gene.

RESULTS

Pa grown at 30°C killed S2 cells faster than 37°C-*Pa*, with 50% relative viability reached at 4hr and 8hr, and 10% relative viability at 6hr and 10hr, respectively. Notably, *PauR* was elevated upon contact with S2 cells, compared to medium-only control, then plummeted to control level after 2hr. In contrast to immediate spike of *pau00087* originating from 37°C-*Pa*, its 30°C-*Pa* counterpart was only elevated after 2hr incubation in S2 cells.

CONCLUSION

P. asymbiotica grown at 30°C is more pathogenic to insect cells compared to those grown at 37°C. However, growing temperature is not involved in regulating *PauR* response in pathogenicity. In contrast, *pau00087* of 37°C-*Pa* is more sensitive to the presence of S2 cells and temperature change than 30°C-*Pa* counterpart. Nevertheless, quorum sensing gene *PauR* is consistently and significantly upregulated upon contact with insect cells, which eludes us to suspect a second role of *PauR* in host cell detection.

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Detector Development for MUSE

Until recently, it was thought that the proton radius was known with an uncertainty of 1%. However, experiments at the Paul Scherrer Institute (PSI) involving muonic hydrogen yielded a radius 4% smaller with an uncertainty of .1%, a 7.9σ inconsistency. This problem of properly measuring the radius now requires new and different measurements. The MUon proton Scattering Experiment (MUSE), carried-out at PSI, Switzerland, will thus be the first to utilize elastic muon proton scattering with sufficient precision to address the Proton Radius Puzzle: incompatible measurements of the radius of the proton from electron-based and muon-based measurements.

This project involves the integration of Straw Tube Tracking (STT) and Silicon Photomultiplier (SiPM) detectors into MUSE. STT development takes place at Hebrew University of Jerusalem (HUJI) while SiPM development takes place at PSI. The goal of my work was to establish an adjustable gas mixing system for STT detectors, become more familiar with the SiPM detectors, test new frames for detector assembly, and help with various other projects related to SiPMs and data readout. The results of this work are presented and discussed.

PRIMARY PRESENTER

Jack Hirschman

STATUS

Student – Undergraduate

AUTHOR

Jack Hirschman

RESEARCH MENTOR/ DEPARTMENT CHAIR

Evangeline Downie

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Nociceptive Immunity: Roles of Allatostatin C upon Bacterial Challenge

Traditional models of the pain-response to infection by foreign noxious agents depict the sensation due to the secondary effects of immune infiltration (e.g. inflammation and release of cytokines). However, recent findings have indicated a correlation between pain and bacterial load of *Staphylococcus aureus* in mice. This relationship was due to direct activation of peripheral pain-sensing neurons (nociceptors) by *S. aureus* bacteria, rather than secondary to the immune response. In adapting this theory to the fruit fly model *Drosophila melanogaster*, we have focused on Allatostatin, a protein product released by nociceptors upon activation. Interestingly, Allatostatin is a homolog of the human somatostatin, which is implicated in immunosuppressive effects. Further, in preliminary survival experiments, flies with silenced *AstC-R2* (allatostatin C receptor 2), had the shortest lifespans upon infection with the insect pathogenic bacteria *Photorhabdus luminescens*. Therefore, we aimed at determining whether the decreased survivorship in *AstC-R2* silenced mutant flies was due to immuno-modulating or metabolic effects.

For further elucidation of Allatostatin's role during infection, we generated RNAi lines where the expression of *allatostatin C receptor 2 (AstC-R2)* was silenced ubiquitously. We conducted survival experiments via nanoinjection of wild type and RNAi knocked down *AstC-R2* mutant flies with *P. luminescens* or PBS as a septic injury control. We visualized and measured changes in metabolic activity of the *AstC-R2* mutants versus wild type flies by staining intracellular lipid droplets via Nile Red dye. Finally, we measured the kinetics of bacterial load and gene expression of the immune-related genes *Drosomyocin*, *Cecropin*, and *Eiger* in the RNAi mutants at 3, 12, and 18 hours post-infection.

Our current results suggest that the decreased survivorship among *AstC-R2* mutants is independent of metabolic effects and is rather due to hyperactivation of the Immune Deficiency pathway. Future studies will seek to uncover the immunological mechanisms associated with the decreased survivorship of the *AstC-R2* silenced flies.

PRIMARY PRESENTER

Gary Hovsepian

STATUS

Student – Undergraduate

AUTHORS

Gary Hovsepian

Nathaniel Bachtel

Douglas Nixon

Ioannis Eleftherianos

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ioannis Eleftherianos

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Investigating Skin Sensitization by Hydrazide Chemicals

Skin sensitization potential is an important endpoint for assessing the safety of commercial chemicals expected to have significant dermal exposure. Allergic contact dermatitis (ACD) is a major health concern caused by skin sensitization, for which treatment requires long-term use of medication, considerably increasing health care costs and time out of work. Although there are established methods for assessing skin sensitization potential, they rely on the use of animals, which is both economically and ethically unfavorable. In contrast to these methods, an *in silico* (computer-based) model is animal-free and can be designed to have superior accuracy at a fraction of the cost and time required for previously established methods. An important limitation of whole-animal tests for assessing skin sensitization is the lack of mechanistic insight in determining how particular classes of chemicals elicit sensitization response. Hydrazines represent one specific chemical class that is very poorly understood. Hydrazine-containing chemicals (called hydrazides) are widespread in the chemical industry and have uses ranging from pharmaceuticals to resins and fluorescent probes to pesticides. Many of these chemicals or their precursors cause skin sensitization; however, the extent of the response varies. There is currently no *in silico* model that can reliably predict the sensitization potency of this important class of chemicals. This project aims to develop an *in silico* prediction model for the skin sensitization of hydrazines and their precursors and to aid in the development of the necessary molecular-level understanding of the mechanisms of sensitization for hydrazides. By evaluating a series of hydrazine-containing compounds obtained from the EChA database for which experimental sensitization (i.e. *in vivo*) data exists, we have developed a structure-based approach that can be used to classify hydrazines as sensitizers or non-sensitizers using SMARTS, a language for identifying substructural patterns in molecules. We are currently working toward integrating said SMARTS patterns with physicochemical descriptors to develop a robust *in silico* model for skin sensitization potential of hydrazines. To guide our modeling efforts and elucidate mechanisms of skin-protein haptenation, we are investigating *in chimico* reactivity of selected hydrazines using a DCYA as a model skin peptide. Integrating *in chimico* data with an *in silico* model will allow us to predict skin sensitization of hydrazines with superior accuracy and strengthen our model with mechanistic knowledge that is currently unavailable for hydrazine skin sensitization.

PRIMARY PRESENTER

Helia Imany-Shakibai

STATUS

Student – Undergraduate

AUTHORS

Helia Imany-Shakibai

Jakub Kostal

Adelina Voutchkova-Kostal

RESEARCH MENTOR/ DEPARTMENT CHAIR

Adelina Voutchkova-Kostal

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Patterns of Sexual Dimorphism in the Pelvis of Apes and Humans

The pelvis is essential in understanding adaptation as it provides information about locomotor and obstetric (gestation and birthing) behavior, particularly in humans. The human pelvis is sexually dimorphic, mainly because human females deliver large infants through a relatively tight obstetric canal in the pelvis. However, little is known about the extent of sexual dimorphism in the pelvis of living apes. Although great apes are not thought to have difficult labors and deliveries like humans, the lesser apes (gibbons and siamangs) are thought to birth infants with relatively large heads, perhaps resulting in sexually dimorphic pelves as well. This study aims to quantify pelvic dimensions and the sciatic notch angle in a large sample of apes and humans, and test whether apes display similar patterns of pelvic dimorphism as humans.

Nine measurements were selected to best capture the overall shape of the pelvis in the following genera: *Homo* (humans), *Pan* (chimpanzees and bonobos), *Gorilla* (gorillas), *Pongo* (orangutans), *Hylobates* (gibbons), and *Symphalangus* (siamangs). Measurements were collected using Geomagic Wrap software from surface scans of hipbones. Pairwise comparisons for each measurement between males and females of each genus were analyzed using a two-sided t-test to determine statistical significance. Lengths were scaled to the pelvis size (approximated by its geometric mean) and visualized as boxplots to inspect patterns in the data. For the measurements in which there was a statistically significant difference between males and females, a regression analysis was performed to investigate whether these differences might relate to size differences between males and females.

Several interesting sex-specific patterns emerge in the ape pelvis. Sciatic notch angle is generally larger in females across all ape species, like humans. Pairwise comparisons find that females of all species (except lesser apes) have a longer sciatic notch height than males, although only female *Pan* display an allometric scaling relationship. Also like humans, female apes also display a trend of having longer pubic bones than males, although only female *Hylobates* and *Gorilla* are significantly larger than male counterparts. Although male and female *Hylobates* are about the same body size, we find that the pubis length scales differently with pelvis size between sexes, with males scaling isometrically and females scaling with slight negative allometry. This study suggests that key pelvic lengths related to obstetric canal dimensions show some evidence of sexual dimorphism in apes, although no ape displays the pronounced pelvic sexual dimorphism seen in humans.

PRIMARY PRESENTER

Susanna Israelsson

STATUS

Student – Undergraduate

AUTHORS

Susanna Israelsson

Sergio Almécija

Ashley S. Hammond

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ashley S. Hammond

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Large Deletion Events Observed in Bacterial Artificial Chromosomes Suggest *Sptransformer* Immune Gene Family Instability in *Strongylocentrotus Purpuratus*

The *SpTransformer (SpTrf)* gene family in the purple sea urchin, *Strongylocentrotus purpuratus*, is a complex system that functions in immune responses to microbial pathogens. The *SpTrf* genes are linked in tight clusters in the genome, are associated with segmental duplications, intergenic repeats, shared sequence, and short tandem GA/GAT repeats. The gene family structure has been the basis for the hypothesis that this genomic region is unstable, which may drive gene conversion, duplication, and deletion events that cause sequence diversification among the clustered genes. Large regions of the sea urchin genome that harbor a cluster of seven *SpTrf* genes called Cluster 1 were inserted into bacterial artificial chromosome (BAC) clones to examine whether the *SpTrf* gene clusters may be prone to genomic instability. To test this hypothesis, BACs were evaluated from single colonies after a 10 day growth period. Four BACs with overlapping inserts were analyzed for changes in insert sizes including changes to Cluster 1. Colony 15 of BAC10B1, with all seven genes, lost a gene at one end of the cluster but retained the rest of the cluster, resulting in a loss of ~91 kB from the original 157 kB insert size. Colony 4C of BAC4074J14, also with seven genes, lost regions outside of the cluster, resulting in a loss of ~81 kB from the original 142 kB insert size. Colony 2B, also of BAC4074J14, lost all genes except the gene at the start of the cluster, with a loss of ~114 kB. Alternatively BAC14k16, with only one gene at the other end of Cluster 1, did not show any size change. Results are consistent with our hypothesis that BAC inserts with multiple *SpTrf* genes are unstable in *E. coli*. The variation in BAC insert size may be a result of genomic instability leading to DNA deletions due to the repeats and shared sequence. This suggests that the *SpTrf* gene clusters in the sea urchin are also likely to be unstable, which may underpin sequence diversification mechanisms. This may lead to highly variable *SpTrf* gene composition and allow for selection and adaptation against constantly changing pathogens and to provide a significant evolutionary advantage in the immunological arms race.

PRIMARY PRESENTER

Abiha Jafri

STATUS

Student – Undergraduate

CO-PRESENTER

Farhana Momtaz

AUTHORS

Abiha Jafri

Farhana Momtaz

Megan A. Barela Hudgell

L. Courtney Smith

RESEARCH MENTOR/ DEPARTMENT CHAIR

L. Courtney Smith

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Analysis of the Role of HDAC6 in the Expression of Clustered Waves of Cytokine-Stimulated Genes in Melanoma

Various studies have shown that aberrant activity of histone deacetylase (HDAC) enzyme plays a major role in key oncogenic events. Pan-HDAC inhibitors act broadly on all isoforms of the zinc-dependent classes of HDACs, but, they have adverse effects. Thus, targeting individual isoforms of HDACs becomes important. HDAC6 which belongs to class IIb of the zinc-dependent family of HDACs, is found to play a significant role in different cellular processes, most of which are involved in immune regulation. Recently, the expression pattern of different HDAC target genes are shown to be timely regulated upon cytokine stimulation. Thus, to further investigate these unexplored regulatory mechanisms, we treated Non-Target (NT) and HDAC6 knocked-down (KD) human melanoma WM164 cell lines with two cytokines namely, IL-6 and IFN-gamma. IL-6 is involved in the recruitment and activation of STAT3, which is a well-known target for HDAC6. IFN-γ is an important cytokine in the pro-inflammatory tumour micro-environment. The RNA samples were collected in a time dependent manner, from 0 to 24 hours at 1 hour interval, to study both the primary and secondary effects of these cytokines on the genes. The RNA-Seq analysis was done and the genes showing similar expression patterns were clustered by Meru analysis. A total of 28 different clusters were obtained. All genes in a cluster showed similar expression pattern and the expression was found to be different at different time points. The magnitude of gene expression was found to be different for the HDAC6 KD cells when compared to the NT cells. From the gene ontology analysis of pathways, a total of 7 genes from the IL-6 treated samples were found to be involved in the upregulation of the MITF pathway in Melanoma, an important pathway in the pathogenesis of melanoma. The expression of these genes was validated by performing qRT-PCR with the RNA samples given for RNA-Seq analysis and also by replicating the entire experiment. Various other top pathways involved in melanoma are also being considered for the study. The data from IL-6 treated samples will also be compared with the IFN-γ treated samples. Thus, by doing time course analysis, a total of 7 genes are found to be involved in the upregulation of the MITF pathway in melanoma, which would have not been the case if only a single time point was considered, as done in the routine methods of RNA-Seq analysis.

PRIMARY PRESENTER

Sophiya John Ephrame

STATUS

Student – Graduate

AUTHORS

Sophiya John Ephrame

Debarati Banik

Satish Kumar Noonepalle

Qianqian Zhang

Prathima Vembu

Melissa Beaty

Erica Palmer

Jennifer Kim

Sara Moufarrij

Anelia Horvath

Alejandro Villagra

RESEARCH MENTOR/ DEPARTMENT CHAIR

Alejandro Villagra

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Role of the Gene *Serrano* on Sperm Length in *D. Melanogaster*

The Manier Lab investigates the genetics of post-copulatory sexual selection and how it drives the evolution of unusually long sperm in *Drosophila melanogaster*. The lab also studies the relationship between traits evolving under pre-copulatory sexual selection, such as courtship behavior, and traits evolving under post-copulatory sexual selection, such as sperm length. In *Drosophila*, sperm length plays a vital role in sperm competition for access to the female sperm storage organ known as the seminal receptacle. Previous research in the Manier Lab has identified a number of candidate genes that influence sperm length in *D. melanogaster*. Here, we are examining the effect of the gene *serrano (sano)* on sperm length. We are measuring sperm length of a mutant in which *sano* has been disrupted by insertion of a transposable element in comparison with control males produced by crossing the mutant with its wild type genetic background. Sperm were dissected from virgin males, fixed and stained, and imaged under darkfield and fluorescence microscopy. Sperm were measured using ImageJ, and data were analyzed using the statistical software R. *sano* plays a role in embryonic development in *Drosophila*, specifically with respect to establishing an open tracheal system and planar polarity of ommatidia of the eye. My research will determine if *sano* is involved in the development of sperm during gametogenesis as well as during embryonic development. Ultimately, this gene represents a potential functional connection between development and post-copulatory sexual selection through its hypothesized involvement in the development of sperm length.

PRIMARY PRESENTER

Elina Kapoor

STATUS

Student – Undergraduate

AUTHORS

Elina Kapoor

Mollie Manier

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Drosophila Immune Gene Suppression Following the Injection of Excretory-Secretory Products from Activated Infective Juveniles of the Entomopathogenic Nematode *Heterorhabditis Bacteriophora*

Due to its effective use as a biocontrol agent against insect pests and its relatively close common ancestry with nematode parasites of humans, the entomopathogen *Heterorhabditis bacteriophora* represents an opportune locus of study for the identification of generalized nematode virulence factors that target host immune systems. Because these immunosuppressive factors are likely to be present in the excreted-secreted (ES) products of the nematode, *H. bacteriophora* infective juveniles (IJ) were first exposed to a solution containing the hemolymph of a natural lepidopteran host, *Galleria mellonella*, and then subsequently transferred to a buffer solution for the collection of ES products. Following concentration, the ES products were injected into *Drosophila melanogaster* adult flies, allowing for the subsequent collection of *Drosophila* RNA and an RT-qPCR-based analysis of immune gene expression at illustrative time points. The results of these assays demonstrated a specific and substantial suppression of the expression of the antimicrobial peptide diptericin, with upregulation dropping from approximately 600-fold in flies exposed to ES products from non-activated IJs to approximately 200-fold in flies injected with ES products from hemolymph-activated IJs. Broadly, this indicates Imd pathway interference that could serve to diminish the host's ability to respond to either the nematode's pathogenic bacterial symbiont released during the infection, or to tissue damage inflicted by the nematode itself. In association with the concomitant inability of the ES products to elicit mortality in injected flies, this observed reduction in immune responsiveness demonstrates the presence of not directly toxic, but rather immunomodulatory virulence factors that could potentially be exploited to tune the nematode's infective program with the aim of either enhancing the nematode-based biocontrol of agricultural pests, or diminishing the burden of infection on human hosts.

PRIMARY PRESENTER

Eric Kenney

STATUS

Student – Graduate

AUTHORS

Eric Kenney

Jonathan Vadnal

Ioannis Eleftherianos

Damien O'Halloran

John M. Hawdon

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ioannis Eleftherianos

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Subcellular Analysis of Peptides in Single Identified Neurons by Mass Spectrometry

The central nervous system (CNS) of the pond snail species, *Lymnaea stagnalis*, is composed of eleven ganglia containing ~20,000 neurons that form complex neuronal networks. These neurons produce and release specific types of neuropeptides for regulating distinct snail behaviors, such as respiration and heartbeat. Depending on their subcellular locations, neuropeptides can play distinct functions. Thus, subcellular analysis of an individual identified neuron is necessary to investigate the localized neuropeptide functions. Mass spectrometry (MS) is a valuable tool for analyzing metabolites, lipids, and peptides in single cells. Here we apply capillary microsampling electrospray ionization (ESI) with ion mobility separation (IMS) and MS to analyze the peptide distributions of nuclei and cytoplasms of single F group (Fgp) neurons from the *L. stagnalis* CNS.

The *L. stagnalis* CNS was extracted in saline under a stereo microscope. Neurons from the visceral ganglion were exposed through manual removal of connective tissues with fine tweezers. Neurons were stained with Hoechst 33342 to visualize the nucleus. A micrometer syringe was used to extract Fgp neurons and transfer them to an inverted microscope. Glass capillaries were used to sample the nucleus and cytoplasm of the cells separately. After backfilling the capillary with an electrospray solution, a high voltage of -2000 V was applied to generate an electrospray with ionized subcellular contents. The ions were separated by IMS, followed by mass analysis using a time-of-flight mass spectrometer. Ions were assigned based on accurate mass measurements, and tandem MS, as well as matrix assisted laser desorption ionization (MALDI) MS.

Due to alternative mRNA splicing, two types of Fgp neurons were observed containing distinct types of FMRF-amide like peptides within their cytoplasms. In Type 1 neuron cytoplasm, tetrapeptides, FMRFamide and FLRFamide were identified. The cytoplasm and nucleus for Type 2 Fgp neurons were analyzed separately. Nine peptides, including GDPFLRFamide and SDPFLRFamide, were detected in cytoplasm, and six of them were also observed in nucleus. These peptides showed distinct relative abundance difference between the cytoplasm and nucleus. For example, neuropeptides, such as GPSRSSFPRYamide and SKPYMRFamide, showed higher abundances in the cytoplasm compared to the nucleus, whereas heptapeptides, such as GDPFLRFamide and SDPFLRFamide, were more abundant in the nucleus of type 2 neurons compared to cytoplasm. In addition, a new 28 residue peptide was detected and identified using single cell tandem MS.

PRIMARY PRESENTER

Nikkita Khattar

STATUS

Student – Undergraduate

AUTHORS

Nikkita Khattar

Linwen Zhang

Ildiko Kemenes

Gyorgy Kemenes

Zita Zrinyi

Zsolt Pirger

Akos Vertes

RESEARCH MENTOR/ DEPARTMENT CHAIR

Akos Vertes

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Animal Model Simulating MS and Exercise's Impact on Adult Hippocampal Neurogenesis

While multiple sclerosis (MS) is typically understood as an autoimmune disease that degrades motor functioning, it can also have significant impacts on cognition. Previous studies suggest that MS affects the hippocampus, damaging patients' cognitive spatial and memory abilities. Dysregulation of adult hippocampal neurogenesis (AHN), the birth of new granule cells (neuroblasts) which are necessary for proper memory formation, may be a mechanism by which MS disrupts hippocampal functioning. Some research suggests that exercise may lessen some neuropathological effects of MS. The present study utilized marmoset monkeys (*Callithrix jacchus*) to model the neurobiological impacts of MS and exercise therapy on AHN. Eight adult male marmosets were sensitized to myelin oligodendrocyte (MOG) glycoprotein (MOG 34–56) in incomplete Freund adjuvant. This was injected into eight adult male marmosets, inducing autoimmune encephalomyelitis (EAE) which models the neurobiological effects of MS in humans with relapse-remitting MS. An additional four control subjects were injected with incomplete Freund adjuvant alonesaline. Half of the EAE and control subjects engaged in aerobic exercised for 30 minutes, three days/week for 10 weeks. Sections across the antero- posterior length of the hippocampus were immunohistochemically stained for doublecortin (DCX) as a marker for neuroblasts. Stereologic counts of the absolute number, proportion (relative to granule cells) and density of DCX cells were quantified in the dentate gyrus of the hippocampus, divided into the Granule Cell Layer (GCL) and the Subgranular Zone (SGZ), where neuroblasts proliferate. Our findings showed that although neither EAE nor exercise statuses had a significant main effect on any of the DCX cell measures alone ($p><0.05$), there was a significant interaction between these two variables (ANOVA, $F_{df}=7.103$, $p=0.029$). Exercise increased absolute DCX cell numbers in the EAE group but decreased it in the control group. Similarly, non-significant trends were observed for %DCX cells and DCX cell density. These results suggest a relationship between exercise and EAE's impact on AHN. This supports the hypothesis that exercise mitigates the impacts of MS on AHN. Thus, this interaction may be a physiological explanation of the benefit human patients see with exercise therapy, regarding spatial and memory cognition.

PRIMARY PRESENTER

Jamie R. Kleiner

STATUS

Student – Undergraduate

AUTHORS

Jamie R. Kleiner

Chet C. Sherwood

Kimberley A. Phillips

RESEARCH MENTOR/ DEPARTMENT CHAIR

Chet C. Sherwood

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Importance of Spherical Shot Conformity in Stereotactic Radiotherapy

PRIMARY PRESENTER

Benjamin Kopchick

STATUS

Student – Graduate

AUTHOR

Benjamin Kopchick

RESEARCH MENTOR/ DEPARTMENT CHAIR

Xiangyun Qiu

PURPOSE

Multi-source stereotactic radiotherapy employs highly focused beams positioned to cover 360 degrees in longitude, but with varying degree of latitudinal range that determine the systems solid angle field space coverage and spherical shot conformity. This study investigates the dosimetric effects due to changes in the solid angle coverage.

METHODS AND MATERIALS

Using the monte-carlo photon transport and dosage calculating algorithm, Geant4 Gate, 1500 cobalt-60 beams were positioned around a 10 cm diameter sphere simulating water. All beams were 10 mm in diameter and positioned uniformly within a limited solid angle spacing ranging from a single arc up to 4pi steradians. The target tumor region was simulated as a 2.5 cm diameter sphere centered inside the larger water volume. For each solid angle spacing arrangement, independently computed 3D dose distributions were calculated with a spacing of 1 mm within the target region. These different focal spot intensities were then optimized to minimize the difference between a perfect treatment outcome and a physically possible outcome. Dosimetric comparisons were then performed to compare the different optimal distributions. All plans were conducted using the same optimization algorithm and constraints.

RESULTS

Reducing the field space coverage from 4pi steradians showed insignificant differences in target conformity. However, the volume of healthy tissue did show differences at lower dose levels. Additionally, the dose falloff is dependent on the direction from the target. While 4pi steradians has a uniform falloff in all directions, a more rapid falloff can be achieved along the central axis using smaller field space coverage at the expense of a more gradual decline along the axis of the beams.

CONCLUSIONS

It is suggested that while a larger field space coverage of beams improves the conformity of the dose distribution, it is not necessary to improve the dose conformity of the target. Additionally, this allows a minimum dose to be received by healthy organs that is dependent on the orientation of the beams.

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Functional Characterization of Two IL-8 Isoforms in the Amphibian *Xenopus Laevis*

Interleukin-8 (IL-8) is a cytokine belonging to the CXC chemokine family, a group of soluble proteins with the ability to induce chemotaxis in their target cells. The CXC family can be further divided into two parts based on the presence or absence of the ELR motif, a short amino acid sequence with a functionally polarizing effect. The African Clawed Frog (*Xenopus laevis*) possesses two genes with sequence similarity to the mammalian IL-8; however, one of these putative IL-8 isoforms (IL-8A) contains the ELR motif while the other does not (IL-8B). The present research aims to characterize the functional roles of both IL-8 isoforms in *X.laevis*, as well as to elucidate the effect of the ELR motif on protein function. *In vivo* and *in vitro* experiments in both tadpoles and adult frogs have demonstrated that both isoforms exhibit the classical chemoattractive properties of their mammalian counterpart. *In vitro*, both IL-8A and IL-8B are expressed in a variety of tissues, although only IL-8A is differentially expressed after cases of immunological challenge or wounding. Further experiments demonstrate the ability of each isoform to regulate the expression of hallmark pro-inflammatory genes in target cells.

PRIMARY PRESENTER

Daphne Koubourli

STATUS

Student – Undergraduate

AUTHORS

Daphne Koubourli

Leon Grayfer

RESEARCH MENTOR/ DEPARTMENT CHAIR

Leon Grayfer

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Muse Trigger and Data Acquisition (TDAQ) System

A 7σ discrepancy exists between electronic and muonic measurements of the proton charge radius. This discrepancy is known as the "proton radius puzzle". MUSE (MUon proton Scattering Experiment) will simultaneously measure cross sections for μ±p and e±p scattering in the PSI (Paul Scherrer Institute) πM1 beam line. This will provide key missing experimental input to the puzzle: a precise measurement of muon-proton elastic scattering, with a strong systematic constraint through the simultaneous electron-proton measurement. The measurement of both charge states will allow extraction of the two-photon effect contribution for both muons and electrons.

The purpose of this work is to discuss the trigger and data acquisition system for MUSE. An overview of the progress of trigger development and the current status of the DAQ will be discussed. Planned improvement to the system that will be implemented during the fall beam time will also be presented.

PRIMARY PRESENTER

Ievgen Lavrukhin

STATUS

Student – Graduate

CO-PRESENTER

Jack Hirschman

AUTHORS

Ievgen Lavrukhin

Jack Hirschman

Evangeline Downie

RESEARCH MENTOR/ DEPARTMENT CHAIR

Evangeline Downie

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Building Time Series Model for Wind Power Forecast

With the depletion of unrenewable resources, new concepts of "sustainable development" "environment-friendly" are increasingly popular, which makes the utilization of renewable resources a global focal point. Comparing to the unrenewable resource, wind power, as an example of renewable resource, has several advantages like cost-effectiveness and free-pollution. According to World Wind Energy Association, the entire world wind power was up to 270 billion kilowatts in 2007, which shows the great potential of wind power industry. Naturally, a power prediction model is definitely necessary to better use wind power.

Brown (1984) was the first one who applied forecast model in wind power industry. Since then, many mathematicians and statisticians spare no effort in promoting wind power forecast models. Many recent studies have focused on short-term forecasts of wind power and hybrid method.

However, the importance of time series character of wind power data is not highlighted by most of the previous researchs. We pay more attention to this character and apply time series specific model-ARIMA to forecast wind power. ARIMA (autoregressive integrated moving average model) is a generalization of ARMA (autoregressive moving average model), which is suitable for time series data either to better understand the data or to predict future points in the series (forecasting). ARIMA is usually applied in cases where data show evidence of non-stationarity, where an initial differencing step (corresponding to the "integrated" part of the model) can be applied one or more times to eliminate the non-stationarity. A data series is said to be stationary when its mean, variance, and auto-covariance are all constant, which can be tested by ADF test in R. Considering the intrinsic nonstationary character of wind power, we will apply ARIMA as our model to predict wind power. If wind power can be predicted more accurately, the usage of it will be more effective, which could greatly ease energy pressure faced by human.

Our research includes six tasks, data gathering, data pre-processing, data importing and smoothing, model fitting, model examination, and model application. In this process, we build an ARIMA to forecast wind power. Then we apply this model to test whether it is useful to test out-sample data and refit the parameter to find the better model.

PRIMARY PRESENTER

Jiaying Liu

STATUS

Student – Graduate

CO-PRESENTERS

Yuxin Zhao

Lingling Chen

AUTHORS

Jiaying Liu

Lingling Chen

Yuxin Zhao

RESEARCH MENTOR/ DEPARTMENT CHAIR

Natalia Dolgova

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Microprobe CE-ESI-HRMS for *In-Situ* Analysis of Proteins and Metabolites in Single Embryonic Cells

The establishment of cell-to-cell heterogeneity in the developing embryo is essential to the proper formation of different tissues in vertebrates. For example, in the South African clawed frog (*X. laevis*), cells of the 16- and 32-cell embryos have stereotypical tissue fates. Using tools capable of measuring molecules, such as proteins and metabolites with single cell resolution can help understand how cell heterogeneity drives embryo development. We previously developed a capillary electrophoresis electrospray ionization platform hyphenated to a high-resolution mass spectrometer (CE-ESI-HRMS) allowing for the measurements of proteins and metabolites from single cells. Additionally, advanced sampling have enabled us to collect cell extracts from live embryos with limited damage. Here, we built on our latest microprobe sampling approach by enhancing the sampling resolution, to allow for sampling and measurement of proteins and metabolites from the same embryonic cell. We used dual-microsampling to collect two portions of the cytoplasm from the same cell to measure proteins and metabolites from two different cells, specifically the D1 and V1 cell, in the same 8-cell embryo. We withdrew an ~10 nL volume of the cytoplasm for each sampling event. Proteins were reconstituted in 50 mM ammonium bicarbonate and trypsin-digested. Metabolites were extracted in 40/40/20 acetonitrile/methanol/water solution. An ~10 nL portion of the samples was used for CE-ESI-HRMS analysis. We reproducibly identified 335 protein groups and detected 150 metabolite features among which 50 were confidently identified.

Intriguingly, the metabolic and proteomic data provided complementary information on the molecular state of the cells. The two different cells separated in hierarchical cluster analysis (HCA) based on their detected proteome, but not their detected metabolome. Moreover, 5 metabolite features and 6 proteins were significantly differentially expressed (fold-change >1.5; p-value <0.05, paired student *t*-test) between the D1 and V1 cells. Using the new metabolomic and proteomic information, we performed pathway enrichment analysis and found the arginine and proline metabolism pathway as one of the most significant (p-value $<2.9 \times 10^{-12}$), which suggests its importance in early embryonic development. These data provide the first example of metabolomic and proteomic analysis on the same single cell directly in the live embryo providing new information on cell heterogeneity in the 8-cell frog embryo. Moreover, the technology promises to deepen our understanding of the mechanisms involved during embryonic development.

PRIMARY PRESENTER

Camille Lombard-Banek

STATUS

Student – Graduate

AUTHORS

Camille Lombard-Banek

Rosemary M. Onjiko

Sally A. Moody

Peter Nemes

RESEARCH MENTORS/ DEPARTMENT CHAIRS

Peter Nemes

Michael King

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Interference of Neutron Beams with Different Topological Charges

While a significant amount of research into the properties of neutron beams and neutron diffraction has been done, there is new research to be done on topological neutron beams. Neutrons interact with the atomic nuclei, which provides unique diffraction patterns. These topological beams consist of neutrons with orbital angular momentum around the axis of propagation, which means that the neutron's wave function across the beam has a phase shift of pi, 2pi, 3pi, etc., and have vast implications in the quantum world. The objective of this research is to model and further explore topological neutron beams, specifically the interactions of neutron beams with different topological charges. These beams are specifically selected for their wavelength, topological charge and speed, with the focus being on thermal neutrons - slow moving neutrons with velocities on the order of 300 m/s. At these speeds, the wavelike nature of neutrons is evident and they will behave like waves in scattering materials. This allows for the study of interference patterns between the beams with different topological charges. These interference patterns, once modeled and analyzed, have implications in the probes of thermal neutron scattering, which is currently being studied at the National Institute of Standards and Technology (NIST).

PRIMARY PRESENTER

Samantha Lumpkin

STATUS

Student – Undergraduate

AUTHOR

Samantha Lumpkin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Andrei Afanasev

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Light Field Imaging Tomography: A New Diagnostic Method for Measuring Byproducts of Combustion Reactions

Combustion processes account for approximately 80% of the US energy production. Reliance on combustion processes, in the US and internationally, will likely continue for the next century, and perhaps beyond. This research is focused on the development and demonstration of a new diagnostic method known as Light Field Imaging Tomography (LFIT) for measuring various species in combustion systems. This has importance to the combustion research community, and to broader society, as it will enable a better determination of the mechanism of pollutant formation in flames. Specifically, the method discussed below uses a laboratory flame system and aims to improve our ability to detect soot particulate - one of the leading environmental causes of death and disease and the second largest cause of global warming after carbon dioxide - and nitrogen oxides - molecules that participate in smog formation as well as acid rain when released into the atmosphere. However, once demonstrated, this technique would also work on a host of other compounds involved in combustion reactions. This work has been done through the Laser Analytics Laboratory, headed by Professor J. Houston Miller, which has a long history of developing optical-based sensors for future applications to real world combustors.

PRIMARY PRESENTER

Logan Malik

STATUS

Student – Undergraduate

AUTHORS

Logan Malik

J. Houston Miller

RESEARCH MENTOR/ DEPARTMENT CHAIR

J. Houston Miller

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Testing the Homeotic Role of Ultrabithorax in the Differentiation of Butterfly Anterior vs. Posterior Wing Patterns

Butterflies have two sets of wings, each possessing a unique identity, conferred by the overall wing pattern, scale morphology, and pigmentation. The mechanisms behind patterning along the anterior-posterior axis during development are important for understanding this differential wing patterning in butterflies. Ultrabithorax (Ubx) is a well-studied Hox gene in arthropods that plays a role in anterior and posterior wing pattern identity in butterflies. Ubx has been shown to be important for forewing and hindwing pattern differentiation (Lewis et al., 1999; Weatherbee et al., 1999), but its necessity has not been tested. To test the homeotic function of Ubx in butterflies, we are using CRISPR-Cas9 to induce Ubx knockout mutations, a technique that can generate mosaic phenotypes on the wings of our butterfly model species, the Painted Lady Vanessa cardui. We hypothesize that the mutants will possess hindwings with forewing pattern identities.

PRIMARY PRESENTER

Caroline Mehta

STATUS

Student – Undergraduate

AUTHORS

Caroline Mehta

Nora Wolcott

Jose Hermina

Chris Day

Arnaud Martin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Arnaud Martin

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Functional Characterization of Two NCLX-Type Transporters in *Caenorhabditis Elegans*

Sodium calcium transporters regulate intracellular calcium levels. This super-family is made up of three subtypes that are distinguished based upon their substrate specificity. Sodium calcium exchangers (NCX) exchange sodium for calcium ions across the membrane; sodium calcium potassium exchangers (NCKX) regulate the exchange of calcium with sodium and potassium ions, while sodium calcium lithium (NCLX) exchangers regulate the exchange of sodium or lithium for calcium ions. These transporters are expressed in all excitable cells including neurons and cardiac myocytes and have been implicated in diverse human disease pathways such as Parkinson's and Alzheimer's disease. The goal of this study is to functionally characterize two NCLX-type exchangers named *NCX-6* and *NCX-7* using the model system *Caenorhabditis elegans*. We have found that both *ncx-6* and *ncx-7* are expressed in intestinal and chemosensory cells, and using CRISPR-Cas9 gene editing have engineered lesions in the genes encoding each exchanger (i.e. *ncx-6* and *ncx-7*) and are characterizing the behavioral defects of these *ncx-6*$^{-/-}$, *ncx-7*$^{-/-}$, and *ncx-6*$^{-/-}$ *ncx-7*$^{-/-}$ double mutant animals.

PRIMARY PRESENTER

Emily Mobbs

STATUS

Student – Undergraduate

AUTHORS

Emily Mobbs

Katrin Bode

Damien O'Halloran

RESEARCH MENTOR/ DEPARTMENT CHAIR

Damien O'Halloran

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

So Long and Thanks for All the Vertebrae: *Klamelisaurus Gobiensis* and the Evolution of Long-Necked Sauropod Dinosaurs from the Middle-Late Jurassic of China

Sauropod dinosaurs are the largest terrestrial animals ever to have walked the earth, and the Mamenchisauridae – a radiation of mostly Chinese taxa from the Middle-Late Jurassic and possibly Early Cretaceous – were the first sauropods to evolve exceptionally long necks, measuring nearly nine meters in *Mamenchisaurus hochuanensis*. At least fifteen sauropod genera are recognized from the Middle and Late Jurassic of China, but the anatomy of these dinosaurs has not been adequately described and only a handful have been included in modern phylogenetic analyses to infer their evolutionary relationships. Here, we present the first phylogenetic analysis of *Klamelisaurus gobiensis* from the lower beds of the Middle-Late Jurassic Shishugou Formation, conducted as part of a redescription of the taxon, and identify a suite of synapomorphies that diagnose Mamenchisauridae.

PRIMARY PRESENTER

Andrew Moore

STATUS

Student – Graduate

AUTHORS

Andrew Moore

James Clark

Xing Xu

RESEARCH MENTOR/ DEPARTMENT CHAIR

James Clark

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Testing the Function of Newly Identified Small Proteins in the Mycobacterial Ribosome

Our previous studies on mycobacteria suggested that their ribosomes have unusual properties. We found that approximately one quarter of mycobacteria transcripts are produced lacking a 5′ UTR and a Shine-Dalgarno ribosome binding site. In most organisms, these two features are required for ribosome assembly and to indicate where mRNA translation should initiate. The mechanism of how translation initiates in these Leaderless transcripts is poorly understood. We hypothesized that mycobacterial ribosome proteins enable Leaderless mRNA translation. We tentatively identified two small proteins, 0945 and 1916, encoded in *Mycobacterium smegmatis* that are associated with the ribosome. Recent independent analysis confirmed this and located these proteins near the active center of the ribosome, consistent with 0945 and 1916 playing a role in ribosome function. To explore the function of these two proteins, we created knockouts of each of these genes in *M. smegmatis*. We then electroporated luciferase reporter genes from either Leadered or Leaderless initiation codons into the knockouts. Using luciferase assays, we analyzed the translation efficiencies in the knockout strains and in wild type cells. In addition to these reporters, we are also subjecting these knockouts to ribosome profiling to examine all of the mRNAs transcribed by the mycobacteria and where the ribosomes are translating the mRNA. Collectively, our reporters and profiling should determine whether these new, small additions to the mycobacterial ribosome enable Leaderless translation initiation. Regardless of the role of these proteins in Leaderless translation initiation, we will continue to assess other roles in ribosome function and antibiotic resistance.

PRIMARY PRESENTER

Katherine Nemeth

STATUS

Student – Undergraduate

AUTHOR

Katherine Nemeth

RESEARCH MENTOR/ DEPARTMENT CHAIR

Todd Gray

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Evolution of Sperm Length within a Lab Environment in *Drosophila Melanogaster*

Males of the fruit fly *Drosophila* produce extraordinarily long sperm, up to 5.8 cm in *D. bifurca*. Evolution of long sperm in *Drosophila* is driven by postcopulatory sexual selection mediated by sperm competition, which occurs when females mate with multiple males and store sperm within specialized sperm storage organs. Sperm length has been shown to have a strong genetic component, yet production of extremely long sperm in certain species delays reproductive maturity by several weeks. The objective of this project was to determine if the lab environment can promote the evolution of sperm length in *D. melanogaster*, through the great availability of high-quality resources (fly food). We collected *D. melanogaster* from a local wild population, brought them into the lab, and reared them for 5 generations on high-protein fly media. For generations 0, 1, 3, and 5, adult males were collected, dissected, and their sperm were fixed and imaged using darkfield microscopy. Sperm images were measured using ImageJ, and data were analyzed using R. Our results will have implications for understanding the interaction between genetic and environmental components that contribute to sperm length and postcopulatory sexual selection.

PRIMARY PRESENTER

Daniella Olonilua

STATUS

Student – Undergraduate

AUTHORS

Daniella Olonilua

Mollie Manier

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Capturing 3D Locomotor Kinematics in Wild Mountain Gorillas (*Gorilla Beringei Beringei*)

Paleoanthropologists have long been interested in reconstructing the locomotion of our early ancestors, to understand how human bipedalism evolved. As our closest living relatives, the African apes serve as an important comparative context for understanding locomotion in our fossil relatives. However, while functional interpretations for skeletal morphology of living and fossil taxa are often made based on comparative locomotor data for extant taxa, detailed locomotor data for the African apes are quite limited. In particular, 3D kinematic (video-based motion analysis) data on living apes are rare, and nonexistent for wild populations. Thus, how apes move around their natural environments remains poorly characterized from a quantitative perspective. Recent advances in technology have generated new methods for practical field-based kinematic data collection.

Here we describe preliminary results from the novel implementation of non-invasive stereo-photogrammetric 3D kinematic methods in the field, focusing on wild mountain gorillas from Bwindi Impenetrable National Park, Uganda and Volcanoes National Park, Rwanda. Multiple Go-Pro cameras were used to record synchronized video of mountain gorilla locomotion, including both terrestrial and arboreal behaviors. Using 'videogrammetry', 3D point clouds representing each video frame were generated, and virtual markers were collected to calculate 3D joint angles. This study presents, for the first time, 3D joint angles during vertical climbing in mountain gorillas, and compare this to published data on captive lowland gorillas. We compare the results of the new videogrammetry method with more traditional wand-calibration methods.

During climbing of a large-diameter tree, the range of motion (ROM) at the knee joint (~40°) is reduced compared to that of climbing small-diameter substrates; the ROM at the elbow is also relatively small (~15°), and generally remains extended throughout the stride.

This study provides the first kinematic data available for mountain gorillas. Investigating 3D kinematics of wild apes will fill in a critical gap in our knowledge of African ape locomotion, and quantitative characterization of differences in locomotion among wild-living apes will help resolve long-standing questions about the evolution of locomotor behavior in apes and humans. Results presented here indicate that it is possible to quantify the kinematics of wild primates to better understand the form-function relationship in living species, data that are essential for making appropriate inferences about locomotor behavior of our fossil relatives.

PRIMARY PRESENTER

Kelly R. Ostrofsky

STATUS

Student – Graduate

AUTHORS

Kelly R. Ostrofsky

Nathan E. Thompson

Shannon C. McFarlin

Martha M. Robbins

Tara S. Stoinski

Sergio Almécija

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sergio Almécija

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Proteomic Characterization of Infection, Immunity, and Mutualism Processes in a Tripartite Model

The entomopathogenic nematode *Heterorhabdis bacteriophora* forms an excellent model to dissect the molecular basis of infection and mutualism in relation to the insect immune response. This nematode lives in mutualistic relationship with the Gram-negative bacteria *Photorhabdus luminescens* and together they are able to infect a wide range of insects. A major advantage of these nematodes is that they are viable in the absence of their mutualistic bacteria, consequently each partner in the mutualistic relationship can be separated and studied in isolation or in combination enabling host immune responses to be studied against each pathogen separately, and against the nematode-bacteria complex together. Investigation of the dynamic interaction between *Heterorhabditis-Photorhabdus* and key aspects of the insect immune system has been facilitated in recent years by the establishment of the tripartite system that involves the fruit fly *Drosophila melanogaster* as the model insect host. These studies have mainly focused on the transcriptional regulation of host insect genes and the identification of genes encoding factors that modulate the response to the nematodes or their bacteria. However, proteomic analyses using the *Drosophila-Heterorhabditis-Photorhabdus* tripartite system have not initiated yet to identify the number and nature of proteins produced during the infection process. We have initiated a project that uses liquid chromatography-tandem mass spectrometry (LC MS/MS) to examine simultaneously the proteome of the nematode parasite, its mutualistic bacteria and *Drosophila* larvae, and detect proteins produced by each organism. We are conducting a quantitative proteomics analysis to compare the changes in protein levels that occur in *Drosophila* during infection with the nematode parasites alone or in combination with their associated bacteria. Comprehensive investigation of the proteome will allow us to identify candidate proteins that might play certain roles in nematode parasitism and bacterial pathogenicity strategies as well as in fly anti-nematode and antibacterial immune reactions. Identification and detailed characterization of host-pathogen interactions at the protein level set the scene for examining the interplay between host proteins that direct innate immune processes and pathogen components that promote host immune invasion or evasion.

PRIMARY PRESENTER

Yaprak Ozakman

STATUS

Student – Graduate

AUTHORS

Yaprak Ozakman

Ioannis Eleftherianos

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ioannis Eleftherianos

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

An Exploration of Hurwitz Orbits of Longer Reflection Factorizations in G4

Given a vector space, we may define reflecting hyperplanes. We may represent the operation of reflection across these hyperplanes via matrices called reflection matrices. These generate a matrix group which is known as a reflection group. If that vector space is over the complex field, then this group is classified as a finite complex reflection groups. There are 37 classes of complex reflection groups—three infinite families and the rest exceptional cases. The focus of this research is one of these exceptional cases, a group called G4. In particular, it focuses on a group action called a Hurwitz move. This is an action which is applied to a reflection factorization of a Coxeter element, a special non-reflection element of the group. This action has been well-studied in real reflection groups and with shortest factorizations in the complex case. The goal of this project is to extend and modify these principles to longer reflection factorizations in complex reflection groups.

PRIMARY PRESENTER

Zachery Peterson

STATUS

Student – Undergraduate

AUTHOR

Zachery Peterson

RESEARCH MENTOR/ DEPARTMENT CHAIR

Joel Brewster Lewis

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Extending the Wings of Wnt: Beyond the Nymphalids

Schwanwitsch's model for butterfly and moth wing patterning, now commonly called the nymphalid groundplan, allows for description of essentially all of Lepidoptera using a set of conserved elements—symmetry systems, umbrae, discal spots, and border ocelli—making it a potential centerpiece of evolutionary development. The nymphalid groundplan is supported by extensive morphological evidence from both Schwanwitsch and later authors, and may also have genetic basis in the Wnt family of morphogens. *WntA* for instance is required for formation of symmetry systems in several nymphalid species with conserved wing arrangements, as well as for patterns that depart more drastically from the groundplan's elements such as *Heliconius* species. As suggested by its name, the nymphalid groundplan is best-studied in the nymphalid family; here we examine the groundplan's molecular underpinnings in the more basal pierid and papilionid families via *Colias eurytheme* and *Protographium marcellus* respectively. This is accomplished via pupal drug injection; heparin simulates heparan sulfate, which occurs as a proteoglycan (HSPG) in the extracellular matrix and promotes formation of Wnt morphogen gradients; dextran sulfate negates these effects. Injection of heparin/dextran sulfate can thus simulate the effects of over- or under- expression of *WntA*, though other heparin-sensitive pathways may also be affected. The resulting adults can then be characterized by shifts in visible and potentially non-visible pattern boundaries.

PRIMARY PRESENTER

Anna Ren

STATUS

Student — Undergraduate

AUTHORS

Anna Ren

Christopher Day

Vincent Ficarrotta

Arnaud Martin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Arnaud Martin

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Axial Organ May Be a Site for Immune Cell Proliferation in the Purple Sea Urchin

The purple sea urchin, *Strongylocentrotus purpuratus*, has a strong innate immune system for defense against a variety of pathogens. Prior work suggests that the axial organ may be a site for the proliferation of coelomocytes (or immune cells) and may remove apoptotic cells from the body fluids, perhaps functioning like a vertebrate spleen. To test whether the axial organ is a source of cell proliferation, sea urchins were injected with EdU, sacrificed three weeks later and axial organs and esophagi (the control) were collected. The tissues were fixed, frozen, sectioned, stained with Hoechst (to indicate DNA), and processed with a Click-iT EdU kit to identify newly proliferated cells and a Click-iT TUNEL kit to identify apoptotic cells. The slides were analyzed using a combination of epifluorescence and confocal microscopy. We compared the number of newly proliferated cells and the number of apoptotic cells in the axial organ and the esophagus relative to the total nuclear count. We hypothesize that the axial organ will have the greater percentage of both newly proliferated cells and apoptotic cells compared to the esophagus. This would suggest that the axial organ is a location for coelomocyte proliferation and removal.

PRIMARY PRESENTER

Caroline Reynolds

STATUS

Student – Undergraduate

AUTHORS

Caroline Reynolds

L. Courtney Smith

RESEARCH MENTOR/ DEPARTMENT CHAIR

L. Courtney Smith

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Facial Soft Tissue Depth Estimation in Mountain Gorillas and Implications for Hominid Facial Reconstruction

Facial reconstruction has traditionally been employed in the context of forensic investigation in creating three-dimensional depictions of a deceased individual from skeletal remains for purposes of identification. The implementation of facial reconstruction techniques to the reconstruction of faces of extinct hominids is pertinent to our overall understanding of human evolution, specifically in resolving scholarly debates regarding the classification of certain fossil species, and a critical part of our ability as researchers to connect with public audiences. The comparative anatomy of our closest living relatives is key to our assessment of relationships between bone and soft tissue that might allow for estimation of soft tissue in extinct forms. A central challenge in creating realistic and scientifically accurate reconstructions is the prediction of soft tissue depth and shape from skeletal remains. As much of the soft tissue of the face is not directly associated with the skull (i.e. some craniofacial muscles have no attachment to the skull but rather originate and insert into the soft tissue alone) many predictions have been subjective in nature and empirically unjustifiable. This study aims to assess the correlation between craniofacial shape and facial soft tissue depth (FSTD) in Gorillas and to determine the extent to which it is possible to predict FSTD from underlying skeletal elements using landmark analysis and photo-skull superimposition techniques. Examined here are (1) the extent to which mountain gorilla FSTD values can be estimated from a blended photographic superimposition and algorithmic image depth mapping process, and (2) how closely values obtained from this process measure in comparison to actual FSTD values obtained from modern mountain gorillas.

PRIMARY PRESENTER

Marli Richmond

STATUS

Student – Graduate

AUTHOR

Marli Richmond

RESEARCH MENTOR/ DEPARTMENT CHAIR

Shannon McFarlin

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Annotation of 4E-T Gene on the Dot Chromosome of *Drosophila Takahashii*

Extensive research has accumulated on the fruit fly *Drosophila melanogaster* as a model organism. In particular, its well-studied genome is important to examining the evolutionary genomics of other *Drosophila species*, like *D. takahashii*. One point of interest is the dot chromosome because of its unique genetic expression: it seems to be heterochromatic, or tightly-packaged and thus transcriptionally dormant, but unlike most DNA of this form, it is actively expressed. By examining the dot chromosome in different *Drosophila* species on a gene-by-gene basis, geneicists may better understand the differences in expression between fruit fly species. I annotated the 4E-T gene in *D. takahashii* using *D. melanogaster* as a reference for gene location and function. The start and end eites of the exons of various isoforms were identified using the UCSC Genome Browser and both FlyBase and NCBI BLAST, and the resulting gene model was verified and refined using the GEP Gene Model Checker. Analysis showed similar lengths in the 4E-T coding sequence between *D. takahashii* and *D. melanogaster*, but with considerable differences in the coding and amino acid sequences between the two species. Thus it is difficult to suggest that the 4E-T protein, which acts in translational control via movement of the translation initiation factor eIF4E in *D. melanogaster*, has similar activity in *D. takahashii*. Further study is necessary to make more rigorous judgements; the 4E-T model created may be a basis for such work.

PRIMARY PRESENTER

Muhammad Talha Salis

STATUS

Student – Undergraduate

AUTHOR

Muhammad Talha Salis

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Phase Singularities in Light Interference Patterns

Superposition of generated light fronts form phase singularities. Light with phase singularities were demonstrated for light and for matter waves like neutrons and electrons. Wave phenomena with phase singularities were spearheaded Berry and Nye in application to acoustic waves originating from earthquakes. Our research is focused on wave dislocations, Berry phases, phase singularities, and topological numbers. Wave dislocations are areas of interference when scattered waves are reflected from a rough surface. Phase singularities are an optical vortex (also known as a photonic quantum vortex) is a zero of an optical field; a point of zero intensity. Berry phases are a phase difference acquired over the course of a cycle. We will demonstrate superposition of light beams with phase singularities will create null singular structures that we will describe in terms of topological charges or winding numbers. Also considering light with fractional topological charges. The overall purpose is to investigate the properties of waves that carry a topological charge and contain a phase singularity and to characterize phase singularities for the interference of waves with different topological charges.

PRIMARY PRESENTER

Tyler Samuels

STATUS

Student – Undergraduate

AUTHORS

Tyler Samuels

Andrei Afanasev

RESEARCH MENTOR/ DEPARTMENT CHAIR

Andrei Afanasev

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Morphological Trajectories During the T1 Transition in Gap-Free Cell Monolayers

The cells in a gap-free monolayer can gain collective motility through an unjamming phase transition, during which the cells' neighbor-switching activity (called the T1 transition) is promoted. Although it is known that the T1 transition involves topological changes in a small group of interconnected cells, it is unclear whether and how such local topological change may be assisted by the global morphological evolution in the whole monolayer. In this work, we analyzed the morphological properties of cells within gap-free monolayers in jammed and unjammed phases. We discovered that there exist morphological "trajectories" along which the cells collectively change their shapes and their alignments during the progression of local T1 transition events. Furthermore, we found that the overall Max-Min Aspect Ratio (MMAR) and the total perimeter of the local cell group both exhibit significant correlation with the transition process. Our results suggest that the morphological arrangement within the entire monolayer is critical for helping cells to locally switch their neighbors.

PRIMARY PRESENTER

George Sangiolo

STATUS

Student – Undergraduate

AUTHORS

Ganhui Lan

George Sangiolo

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ganhui Lan

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Annotation of the *D. Takahashii* Dot Chromosome

The Genomics Education Partnership (GEP) is a nationwide consortium of colleges and universities that offer classroom-based research opportunities to undergraduates. The research program investigates evolution of the small fourth or "dot" chromosome of the fruit fly *Drosophila* across a phylogeny of 26 species. This project requires careful annotation of genes on the fourth chromosome by many undergraduate students. All of the data is compiled, and the most consistent results for ortholog structure are accepted. My research focuses on a hypothesized *D. takahashii* ortholog of the *D. melanogaster* gene Metabolic Glutamate Receptor precursor (mGluR). This gene is responsible for the production of the membrane transient protein often found at neuronal synapses responsible for binding to Glutamate, the nervous system's primary excitatory neurotransmitter. We used several genome analysis web tools to conduct our annotation projects. A gene's location, sequence, and ortholog was hypothesized by Genscan, an algorithm based on several DNA sequence search parameters. Next, various lines of evidence were used to estimate the exact location of start and stop codons as well as splice sites. Among the lines of evidence used were various RNA expression models, the Genscan prediction, chromosomal placement, and strand direction. The actual viability of the ortholog is also tested by comparing its protein sequence against the *D. melanogaster* genome. I found that the Genscan prediction was accurate for the most part, however slight edits of splice sites were necessary based on RNA expression patterns. The gene is located on the same chromosome as mGluR, however is not around the same nucleotide position. The genes match fairly well in some areas with respect to their corresponding polypeptide sequences, but differ significantly in other areas. Therefore the gene may have an orthologous function, or has possibly been adapted to perform a new action.

PRIMARY PRESENTER

Ben Sherman

STATUS

Student – Undergraduate

AUTHORS

Ben Sherman

Mollie Manier

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Rapid, Inexpensive Genotyping and Barcoding of Primates: Multiple Applications for High-Resolution Melt Analysis in Primatology

Research in molecular ecology and conservation genetics often entails genotyping single nucleotide variants (SNVs). High-Resolution Melt Analysis (HRMA) is a simple and economical method for detecting DNA variants by characterizing the sequence-specific melting behavior of short PCR products. To-date HRMA use has largely focused on medical screenings, but this method has numerous potential applications in primatological genetics. We developed and tested (via Sanger sequencing) several protocols demonstrating the convenience and flexibility of HRMA in primatology. First, we assessed the ability of HRMA to discern color vision status in lemurs (n=87 of 9 species) via X-linked opsin genotypes. Differences in melting curves (temperature and shape) allowed us to reliably identify trichromatic and dichromatic individuals with high accuracy. Second, we targeted SNVs commonly associated with autism and/or behavioral tendencies (oxytocin receptor gene, *OXTR*) in humans (n=60) and were able to accurately genotype individuals based on melting curves. Third, we used HRMA for rapid species identification using a segment of cytochrome c oxidase 1 (*COX1*). Results indicate that sympatric primate species, including some lemurs and apes, can be accurately identified using HRMA. Finally, we have used HRMA for health screenings of interleukin-4 (*IL4*) SNVs that are associated with nematode infection loads in *Eulemur rufifrons*. Our results demonstrate that HRMA is a multipurpose and robust method for genotyping simple functional and neutral genetic variants.

PRIMARY PRESENTER

Sheel V. Singh

STATUS

Student – Undergraduate

AUTHORS

Sheel V. Singh

David C. Frankel

Rachel L. Jacobs

Edward E. Louis, Jr.

William D. Hopkins

Brenda J. Bradley

RESEARCH MENTOR/ DEPARTMENT CHAIR

Brenda J. Bradley

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Effectiveness of Three-Axis Accelerometers to Measure Short-Beaked Echidna (Tachyglossus Aculeatus) Behaviour: A Pilot Study Exploring the Replacement of CCTV for Future Breeding Studies

The short-beaked echidna, Tachyglossus aculeatus has a wide distribution covering all bioregions within Australia and parts of New Guinea. Even though they are wide spread they are cryptic, and detailed studies and observations on echidna breeding behaviours has been sparse. Captive breeding programs have become important for this reason, and are important in the conservation and future of T. aculeatus. In order to improve the understanding of echidna breeding patterns and behaviours at the Perth Zoo, WA, two echidnas from the Perth Zoo breeding program were chosen (a male and a female) and fitted with data loggers containing three-axis accelerometers. This, accompanied with visual observations via CCTV footage over the course of eight days, allowed for the understanding of captive behaviours to be recorded and compared with three-axis accelerometer graphic outputs. Through comparing CCTV data to accelerometer data, patterns were able to be matched with specific behaviours, including calibration movements with roll angles similar to those expected from copulation. This pilot study provides a basis for enabling future breeding studies to incorporate the use of three-axis accelerometers, both saving time and increasing the possibility of observing echidna copulations.

PRIMARY PRESENTER

Morgan Southern

STATUS

Student – Undergraduate

AUTHOR

Morgan Southern

RESEARCH MENTORS/ DEPARTMENT CHAIRS

Emily Polla

Peter Mawson

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Dental Emergence in Living Wild Chimpanzees (*Pan Troglodytes Schweinfurthii*) from Gombe National Park, Tanzania

Dental emergence is hypothesized to correlate with life history events in comparative contexts, and is frequently used as a proxy for biological age in living and fossil populations. Current knowledge of dental emergence in living chimpanzees is largely derived from captive samples and the Kanyawara community of wild eastern chimpanzees (*Pan troglodytes schweinfurthii*) in Kibale National Park, Uganda (Smith and Boesch 2011; Smith et al. 2013; Machanda et al. 2015). Variation in tooth eruption timing between wild chimpanzee populations is poorly understood, but critical for understanding the scope and sources of variation in this species. We characterized dental emergence in a second population of wild known age chimpanzees at Gombe National Park, Tanzania (N=18, age 0.59-9.75) using video footage taken over a five-year period. By extracting stills, we assessed the presence and eruption stage of different tooth positions within individuals. All individuals 0.59 years or older had at least partially erupted deciduous dentitions. The youngest age of first molar emergence reported here is 2.65 years old and overlaps with a previous report for Kanyawara chimpanzees. The youngest age of emergence for the permanent maxillary first incisor and canine—5.6 and 8.2 years, respectively—are earlier than in the Kanyawara community, but within the range of captive chimpanzees. By expanding the known sample, a more accurate picture of variation in chimpanzee dental emergence is elucidated. As more data accumulates, future studies should investigate how differences in dental development between and within wild populations may be due to factors such as ecology and maternal condition.

PRIMARY PRESENTER

Lauren Sutherland

STATUS

Student – Undergraduate

AUTHORS

Lauren Sutherland

Matthew R. Heintz

Carson M. Murray

Anne E. Pusey

Kara K. Walker

Kaitlin R. Wellens

Shannon C. McFarlin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Shannon C. McFarlin

COLLEGE OF PROFESSIONAL STUDIES

Incorporating Climate Downscaling in Coastal Resilience Planning

Coastal cities throughout the United States are vulnerable to the devastating impacts of climate change. These impacts are exacerbated when urban planning does not address the various coastal vulnerabilities, such as sea level rise and storm surges, putting these cities at risk of human losses and economic losses. Cities are safer and more resilient when they can respond to these natural disasters with existing tools to provide citizens with a greater quality of life and shelter in case of an emergency. Climate downscaling should be integrated into urban coastal resilience plans to better evaluate the implications of climate change in coastal cities.

Climate downscaling is the procedure of taking large scale climate data and reducing the data to a regional or local scale. General Circulation Models (GCMs) are computer models used to predict climate globally. Because the GCM results are at global scales, the climatic conditions are displayed over longer periods of time (seasonal or annual). GCMs are made of numerous grid cells covering the Earth's surface and are capable of computing: water vapor and cloud interactions, effects of aerosols on radiation and precipitation, changes in snow cover and sea ice, the storage of heat on the land and in the oceans, and the transportation of heat and water by the atmosphere and oceans. While these projections may be useful, they make it more challenging to support adaptation planning for regional policy makers. Climate downscaling can be beneficial on local levels because it shows the impacts of climate change on specific sectors, such as agricultural production, food security, disease prevalence, and population vulnerability.

PRIMARY PRESENTER

Allie Thompson

STATUS

Student – Graduate

AUTHOR

Allie Thompson

RESEARCH MENTOR/ DEPARTMENT CHAIR

Anthony Bigio

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Sequence and Structure Dependent DNA-DNA Interactions

Molecular forces between dsDNA strands are largely dominated by electrostatics and have been extensively studied. Quantitative knowledge has been accumulated on how DNA-DNA interactions are modulated by varied biological constituents such as ions, cationic ligands, and proteins. Despite its central role in biology, the sequence of DNA has not received substantial attention and "random" DNA sequences are typically used in biophysical studies. However, ~50% of human genome is composed of non-random-sequence DNAs, particularly repetitive sequences. Furthermore, covalent modifications of DNA such as methylation play key roles in gene functions. Such DNAs with specific sequences or modifications often take on structures other than the canonical B-form. Here we present series of quantitative measurements of the DNA-DNA forces with the osmotic stress method on different DNA sequences, from short repeats to the most frequent sequences in genome, and to modifications such as bromination and methylation. We observe peculiar behaviors that appear to be strongly correlated with the incurred structural changes. We speculate the causalities in terms of the differences in hydration shell and DNA surface structures.

PRIMARY PRESENTER

Raju Timsina

STATUS

Student – Graduate

CO-PRESENTER

Xiangyun Qiu

AUTHORS

Raju Timsina

Xiangyun Qiu

RESEARCH MENTOR/ DEPARTMENT CHAIR

Xiangyun Qiu

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Rhizobium-Legume Symbiosis and Nitrogen Fixation Followed by In Vivo Sap Analysis Using Direct Electrospray Ionization Mass Spectrometry

The Haber-Bosch process is used to produce more than 10 million tons of nitrogen based fertilizers in the United States per year, costing 6.5 billion dollars annually. Only a small fraction of synthetic fertilizers, however, is absorbed by the crop, whereas the rest causes environmental damage such as eutrophication and the formation of hypoxic zones. Some leguminous plants, such as soybean, do not depend on synthetic fertilizers for nitrogen uptake. Instead, they create mutualistic relationships with rhizobia, soil bacteria that are capable of atmospheric nitrogen fixation. Understanding the biochemical processes involved in this mutualism can have several implications on the global agriculture. For example, the biochemical processes involved in the soybean-rhizobia interaction might eventually be recreated in other crops that are incapable of this symbiotic relationship naturally. To further the understanding of the soybean-rhizobia symbiosis, methods capable of *in vivo* analysis are important for monitoring physiological processes that take place in living plants. Here, we present a new approach for the analysis of endogenous compounds in sap directly from the vasculature of living plants by electrospray ionization mass spectrometry (ESI-MS).

A microloader tip was inserted into a glass capillary backfilled with electrospray solution. A plant stem was cut with a sterile scalpel, resulting in the formation of a sap droplet by root pressure. The droplet was positioned to form a sap bridge with the microloader, causing sap to flow through the microloader by capillary action and mix with the electrospray solution. High voltage was applied by inserting a platinum wire into the solution to generate an electrospray. Isobaric species were separated based on differences in their collision cross sections using ion mobility.

To gain insight into specific compounds involved in the symbiosis, the metabolic composition of sap from infected and uninfected plants was analyzed. Partial least squares-discriminant analysis aided in identifying species that distinguishes the sap from infected plants. Preliminary results indicated that sugar-linked compounds, such as flavonoid glycosides, were more abundant in sap from rhizobia-infected soybean plants. Some nitrogen containing compounds, carbamylcysteine and oxoproline, were also more abundant in infected soybean plants. Plants showed signs of normal growth post-analysis, indicating that the experimental conditions did not impair their viability.

PRIMARY PRESENTER

Tina H. Tran

STATUS

Student – Undergraduate

AUTHORS

Tina H. Tran

Laith Z. Samarah

Sylwia A. Stopka

Rikkita Khattar

Beverly J. Agtuca

Ljiljana Paša-Tolić

Dong Xu

David G. Mendoza

Gary Stacey

Akos Vertes

RESEARCH MENTOR/ DEPARTMENT CHAIR

Akos Vertes

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Elements In $G(r,1,n)$ and Hurwitz Action on their Factorizations

A **complex reflection group** $G(r,1,n)$ is a finite group acting on an n -dimensional complex vector space $GL(C^n)$ that is generated by **complex reflections**: non-trivial elements that fix a complex hyperplane pointwise. Every element in a complex reflection group can be factored into reflections. In this study, we apply the **Hurwitz action**, a conjugacy-class-preserving group action on the reflection factors that does not change the product, to the reflection factors of each element of small examples of $G(r,1,n)$ and investigate the corresponding Hurwits orbits. We find that some elements have transitive Hurwitz orbits and some have non-transitive Hurwitz orbits. This phenomenon is closely related to the subgroup structure of the complex reflection group and the conjugacy classes of reflections in that group. A special type of elements that always have transitive Hurwitz orbits on their reflection factorizations is the **Coxeter elements**. Another interesting property that Coxeter elements have is that their reflection factors generate the whole complex reflection group. In this study, we explore a deeper connection between transitive Hurwitz orbits and Coxeter elements.

PRIMARY PRESENTER

Jiayuan Wang

STATUS

Student – Graduate

AUTHOR

Jiayuan Wang

RESEARCH MENTOR/ DEPARTMENT CHAIR

Joel Lewis

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Blind Searches for Transient Sources Using TRAP and VLITE

The goal of this research project is to continue the search for new transient and variable sources that are found using the VLA Low Band Ionospheric and Transient Experiment (VLITE) instrument on the Very Large Array (VLA) telescope and the Transients Pipeline software. This project focuses on blind searches using the Pipeline, or TRAP of these transients in radio images of large portions of the sky. A transient source is one that has a flux in its brightness in a short burst of time. The research focuses on finding the sources and understanding why they have this change in order to range their physical parameters. TRAP provides us with analyzed data for light curves of the observed source. From these light curves, we are able to obtain statistical values of η, the probability that the data are drawn from the fitted model, and V, which compares the observed scatter in flux densities to the average flux density of the source, that represent the variability of the sources with multiple data points. An η versus V graph is generated to find which sources have large value of both parameters, and these are the most likely points to be transient sources. Once the source has been identified, its position in the sky is used to look at archived radio images over short time scales to see if there is a transient. The observation of these sources can lead to understanding of what transients are and the physical limits of when and where they can occur.

PRIMARY PRESENTER

Alexandra Weikert

STATUS

Student – Undergraduate

AUTHORS

Alexandra Weikert

Justin Linford

Alexander van der Horst

RESEARCH MENTOR/ DEPARTMENT CHAIR

Alexander van der Horst

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Amphibian (*Xenopus Laevis*) Tadpoles and Adult Frogs Mount Disparate Interferon Responses

The Frog Virus 3 (FV3) ranavirus is significantly contributing to the amphibian declines via potentially life-threatening infections. Antiviral interferon (IFN) cytokines have been shown to be fundamental to vertebrate antiviral immunity, including those of the amphibian *X. laevis*. Notably, amphibians are the lowest vertebrates to possess type I and type III IFN families. We have previously demonstrated that adult *X. laevis* respond to water-based FV3 infections exclusively with a type I IFN response in the skin, whereas FV3-challenged tadpoles upregulated type III IFN gene expression in the skin in response to this virus. To further investigate these outcomes, we examined tadpole and adult *X. laevis* skin and kidney (primary sites of FV3 replication) gene expression of a panel of type I and type III IFNs, following stimulation with distinct pathogenic components. Our findings provide a comprehensive evaluation of the *X. laevis* antiviral responses following FV3 infections and offer new insights into the amphibian IFN responses to distinct pathogenic stimuli. Gaining further insight into how IFNs are utilized during amphibian antiviral responses will broaden our understanding of the evolutionary origins of their immune systems and possibly open new possibilities to eliminate the pathogenic contributions to the amphibian declines.

PRIMARY PRESENTER

Emily Wendel

STATUS

Student – Undergraduate

AUTHORS

Emily Wendel

Amulya Yaparla

Leon Grayfer

RESEARCH MENTOR/ DEPARTMENT CHAIR

Leon Grayfer

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Genetic Diversity of *Propithecus Verreauxi* Across Bezà Mahafaly Special Reserve

Understanding how protection strategies influence the genetic diversity of endangered species can benefit conservation and research efforts. Recent expansion of Bezà Mahafaly Special Reserve (BMSR) in southwest Madagascar to include distinct areas that allow varying levels of human activity offers an opportunity to assess the impact of protection levels on the sifaka lemur (*Propithecus verreauxi*) population. Here, we report on preliminary measures of genetic diversity and differentiation across protection areas. We collected 67 fecal swab and pellet samples from sifakas across four areas of the reserve characterized by distinct protection levels and habitat types. We used DNA extracted from these samples to perform sex-typing and microsatellite genotyping at seven loci.

We tested for Hardy-Weinberg equilibrium, estimated average heterozygosity within each of the areas, and tested for differentiation in allele frequencies among the areas of the reserve. The success rate of microsatellite genotyping was above ninety percent, and six of the seven loci were in Hardy-Weinberg equilibrium; these six loci were used for all subsequent analyses. The lowest level of heterozygosity was observed in the sustainable use zone, a newly established area with the lowest level of protection. This area also demonstrated significant differentiation from the other three areas in pairwise comparisons of allele frequencies. Larger-scale analyses regarding the impact of differing and changing protection levels at BMSR that integrate ecological and behavioral data with genetic information are ongoing across all areas.

PRIMARY PRESENTER

Cassandra M. White

STATUS

Student – Undergraduate

AUTHORS

Cassandra M. White

Elaine E. Guevara

Chloe L. Chen-Kraus

Richard R. Lawler

RESEARCH MENTOR/ DEPARTMENT CHAIR

Brenda J. Bradley

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Relationship Between Sperm Length and Testis Size in *Drosophila Melanogaster*

The sperm of *Drosophila melanogaster* are some of the longest that are known, up to 5.8 cm long and 20 times the size of the fly itself. Production of very long sperm challenges that commonly held belief that sperm are cheaper to produce than eggs. In species with extremely long sperm, reproductive maturity is delayed by up to three weeks, as compared with species with much shorter sperm that are ready to reproduce after several hours. The goal of my research is to determine if sperm length is correlated with testis length. A significant relationship between sperm size and testis size would suggest that longer sperm are more metabolically expensive and require a larger organ to produce, providing further evidence against the common wisdom that sperm are cheap. Practical applications of a correlation between sperm and testis length also include being easier quantification of sperm length by using testis length as a proxy.

PRIMARY PRESENTER

Sevan Yedigarian

STATUS

Student – Undergraduate

AUTHORS

Sevan Yedigarian

Mollie Manier

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mollie Manier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Using Electroporation to Obtain Live Imaging of Cytoskeletal Dynamics in the Wings of Vanessa Cardui

Scale development in butterflies is highly controlled by organized filamentous actin (F-actin) structures located in the pupal wings. Previously, the development of scales could only be partially captured by the time series method. This antiquated method captures snapshots of pupal wings in time by comparing dissected pupal wings from several different individuals at different times. The time series method is flawed because it has difficulty in capturing dynamics of wing development and results in a high death rate. Recently, electroporation has risen as an alternative to the time series method because it allows researchers to obtain live images of scale development. LifeAct is an amino acid peptide which stains F-actin structures in eukaryotic cells and tissues. By tagging LifeAct with GFP, we visualized F-actin structures in the pupal wings. Consequently, we were able to observe and understand how F-actin drives the development of scales in pupal wings. Additionally, the previously identified enhancer for the gene Nubbin was isolated from Drosophila and Tribolium and introduced into Vanessa. This process allowed us to drive expression of fluorescent proteins, a key factor in exploring how genes are regulated in pupal wings. Overall, we applied the electroporation technique in order to obtain live imaging of scale development.

PRIMARY PRESENTER

Juan Zaida

STATUS

Student – Undergraduate

AUTHORS

Juan Zaida

Christopher Day

Arnaud Martin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Arnaud Martin

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

"Glass at Risk" — Preliminary Results of an Investigation of Simple Analytical Tools to Understand 19th-Century Heritage Glass Degradation

Despite the common belief that glass is a stable, inert material, many types of glass are inherently unstable due to their composition; deterioration can be further exacerbated by the environmental history of their storage conditions. Caretakers of historical 19th-century glass collections are often unaware of the inherent instability of certain glass types, which can include photographic materials, vessel glasses, and other rare objects. The work presented here focuses on glass flutes produced by Claude Laurent between 1806 and 1848; 20 of which are currently housed in the Library of Congress and nearly 200 Laurent flutes exist worldwide. This work is part of a collaborative project with the ultimate goal of developing simple analytical tools organized into a "decision tree" that will allow end-users of varying backgrounds, from curators and collectors to conservators and conservation scientists, to better identify the risk posed by unstable 19th-century glass in historical collections.

The goal of the collaborative project is to assess simple, portable analytical tools to determine types of at-risk 19th century glass. The flutes demonstrate a broad range of visible deterioration, reflective of the differences in composition and environmental histories. Despite the flutes being advertised as "*en cristal*", or composed of a leaded glass formulation, most flutes analyzed to date have been found to be composed of a potash glass. Contingent on the relative amounts of glass network stabilizer (CaO, PbO) versus glass network modifier (Na_2O, K_2O), some potash formulations can be highly unstable. The 20 Laurent flutes housed in the Library of Congress have been analyzed by ultraviolet (UV) light-induced photography, surface pH, X-ray fluorescence (XRF), fiber optic reflectance spectroscopy (FORS), visible light photography and microscopy. The analytical results presented herein clearly reveal differences in composition and relative state of deterioration. Ongoing work involves compiling a database, consisting of relevant data extracted from the analytical results and historical information, which will then be analyzed using multivariate techniques to understand the relationship between glass composition and risk of deterioration, and how to best develop a preliminary decision tree to assess "at risk" glass. The database and subsequent decision tree produced by this work will significantly enrich the cultural heritage community's preservation of glass objects contained in museums, archives, and historical societies.

PRIMARY PRESENTER

Stephanie Zaleski

STATUS

Postdoc

AUTHORS

Stephanie Zaleski

Lynn Brostoff

Carol Lynn Ward-Bamford

Nikolaus Deems

Elizabeth Montagnino

Andrew Buechele

Isabelle Muller

Ian Pegg

Murray Loew

RESEARCH MENTOR/ DEPARTMENT CHAIR

Murray Loew

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Amylin Aggregation Kinetics

Amylin is a small unstructured protein that aggregates to form amyloids, a type of protein aggregate that has a characteristic cross-beta-sheet structure. Although the exact aggregation mechanism and kinetics are unknown, it is essential to understand this because the amyloid formed by amylin is indicative of Type II Diabetes.This project aims to study amylin aggregation with Dynamic Light Scattering (DLS), a technique that uses the scattering of laser light to determine the time-dependent changes in the size of small particles. These data have been useful in gaining a deeper understanding of the timescale for amylin aggregation and for the development of an amylin-biosensor. Various amylin antibodies are designed to selectively bind to certain types of amylin aggregates, such as monomers or aggregates. The biosensor uses this antibody-antigen binding to produce a signal, however it is unknown what species is actually detected: a monomer, an aggregate, or something in between. Data from DLS can help elucidate this because an understanding of which protein sizes are present at various times in the aggregation process will help determine which species the antibody is binding.

PRIMARY PRESENTER

Kara Zielinski

STATUS

Student – Undergraduate

AUTHORS

Kara Zielinski

Angela Belic

Aleksander Jeremic

Michael Massiah

Mark Reeves

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mark Reeves

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Effect of University Belongingness in Anxiety & Depression Among Emerging Adults

INTRODUCTION

Emerging adulthood is a stage of life characterized by notable personal development across several domains, including social identity. Many emerging adults attend colleges and universities, a context in which substantial social identity growth occurs. James Cameron's three-factor model proposes that social identity is comprised of Centrality, Ingroup Affect, and Ingroup Ties. Centrality refers to the amount of time spent thinking about being a group member. Ingroup Affect refers to the emotions associated with membership in the group. Lastly, Ingroup Ties are the perceptions of similarity, bonds, and belongingness with other group members. Studies have shown that a lack of bonds with social groups predicts negative mental health outcomes, while development of strong social ties predicts positive psychological adjustment to college and lower rates of anxiety and depression. Furthermore, strong social ties to the university have been shown to be associated with lower rates of anxiety and depression. This is particularly important given rates of such internalizing disorders have been increasing in college students, where 21.8% and 13.5% report impairment in functioning from anxiety and depressive symptoms, respectively. The present study hypothesized inverse relationships between social ties to one's university and both anxiety and depression in college students.

METHODS

Undergraduate students (n = 341) attending a private urban university completed self-report matures. These measures included the Penn State Worry Questionnaire, the Beck Anxiety Inventory, and the Patient Health Questionnaire-9. Participants also completed the Three Dimensional Strength of Group Identification Scale to measure aspects of their social identity as students of a university.

RESULTS

Bivariate correlational analysis revealed a significant inverse relationship between overall social identification with the university and depressive symptoms ($r = -.16$, $p < .05$). Ingroup Affect also had a significant inverse relationship with depressive symptoms ($r = -.18$, $p < .05$) and with worry symptoms ($r = -.16$, $p < .05$). Ingroup Ties had a significant inverse relationship with depressive symptoms ($r=-0.24$, $p<.0001$), worry symptoms ($r=-.12$, $p <.05$) and panic symptoms ($r=-.14$, $p <.05$).

DISCUSSION

The findings of the present study support prior research which claim that an emerging adult's connection to their educational institutions may be critical for their psychological well being. The importance of these findings could contribute to lower instances of reported depression and anxiety cases on university campuses. Universities can use these findings to develop programs which foster a sense of community; which could ultimately promote more positive mental health on campus and a strong sense of school spirit among college students.

PRIMARY PRESENTER

Kelvin Adom

STATUS

Student – Undergraduate

AUTHORS

Kelvin Adom

Nicholas Talisman

Kara Meadows

Sage Hess

Cynthia Rohrbeck

RESEARCH MENTOR/ DEPARTMENT CHAIR

Cynthia Rohrbeck

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

From Gold Coins to Bitcoin, The Effect of Demonetization on Cryptocurrency Demand: A Look at India's Trend Toward Digitalization

Demonetization is policy tool that involves phasing out specific currency notes as legal tender in exchange for implementing new notes. This paper estimates the effect of the Indian Government's demonetization scheme and its effect on cryptocurrency demand, specifically looking at the most popular cryptocurrency tender, Bitcoin. This analysis employs a two-pronged approach in testing the relationship between demonetization and cryptocurrency demand. First an ordinary least squares regression produced a statistically insignificant relationship between money supply growth and appreciation of Bitcoin growth relative to the Indian rupee. The presence of demonetization, however, resulted in a statistically significant appreciation of Bitcoin Indian rupee exchange at the 1% significance level. Second, a difference in means analysis between local Indian Bitcoin prices and international Bitcoin exchange produced a statistically significant result at the 10% significance level. Previous research predominantly focuses on shadow economies and demonetization schemes, this research links on analysis of cryptocurrencies and demonetization.

PRIMARY PRESENTER

Vaishali Ashtakala

STATUS

Student – Undergraduate

AUTHOR

Vaishali Ashtakala

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tara Sinclair

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Intercultural and Intracultural Difference in Emotion Perception: How Culture and Ethnicity Shape the Mind

As successful social interactions between different cultures and ethnicities are important in forming a global community, the question arises whether there are any disparities in emotion perception between different groups of people. While previous research suggests that there are differences in emotion perception, memory, and attention between cultures, it is uncertain whether differences in emotion perception may influence these differences in other cognitive processes. This present study explores difference in emotion perception and its impact on word processing, both interculturally and intraculturally, by comparing the performance of participants from the US and South Korea in two different emotion perception tasks. The emotion rating task is a direct measure of the emotion perception of the participants, whereas the word recognition task is an indirect measure of the impact of emotion on word processing. In the emotion rating experiment participants rate a Caucasian facial stimulus on a scale of one to nine based on the level of emotion expressed in the face. In the word recognition task, participants make a decision regarding the emotion of a facial stimulus, followed by a decision regarding the validity a word stimulus. Approximately 500 participants were recruited from an American university and approximately 180 participants were recruited from a South Korean university. In the rating experiment, the data that has so far been collected is consistent with previous research, in that it suggests intercultural difference in emotion perception between American and South Korean participants. For the word recognition experiment, it appears that word processing primed by emotion perception results in longer reaction times to words for American participants as opposed to Korean participants, however significance is still being determined. Preliminary findings also indicate that Americans, regardless of ethnicity, perform more similarly to each other than to Korean participants. These findings suggest that culture may have more of an influence on emotion perception than ethnicity. Such research exploring similarities and differences between various groups of people will continue to contribute to the understanding of how people interact with one another, especially in an increasingly globalized world.

PRIMARY PRESENTER

Margaret Benda

STATUS

Student – Undergraduate

AUTHOR

Margaret Benda

RESEARCH MENTOR/ DEPARTMENT CHAIR

Myeong-Ho Sohn

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Stress Process, Resource Scarcity, and Stress Mitigation Capital: Underlying Mechanisms and Evidence for a Feedback Loop in the Relationship Between the Stress Process and Economic Disadvantage

This paper investigates the role that stress plays in reproducing societal inequalities, describing a concept that links the cycle of stress propagation to the cycle of disadvantage accumulation. Stress emerges from the analysis as an important factor in the reproduction of inequality in society. An array of ethnographic literature describing the experiences of individuals with low socio-economic status is coded for stressors, stress coping, and stress responses/outcomes. Qualitative analysis shows that resource scarcity inhibits individuals from maintaining a sense of control over their lives, and this limited agency in turn impedes the development of stress mitigation capital. Resource scarcity is defined as insufficient economic funds to consistently ensure basic needs and agency is defined as a sense of mastery or control over one's life. Stress mitigation capital is presented as an important factor affecting the vulnerability of an individual or population to the stress process. Extending the theoretical concepts of sociologist Pierre Bourdieu, stress mitigation capital describes factors that provide advantages in social scenarios and relationships involving stress. The findings of this paper are shown to have implications for understanding the relationship between stress and disadvantage that apply in numerous distinct cases.

Analyzing ethnographic literature describing the experience of individuals facing resource scarcity with particular attention paid to stressors, stress coping and stress responses reveals multiple important patterns that support the assertion that economic disadvantage and the stress cycle are linked through a form of capital. This is further contextualized and supported by content analysis of dominant messaging pertaining to stress in society. Specifically, the recent popularization of the concept of "mindfulness" by certain segments of the general public, by pseudo-science, and by the traditional academic community, relies on the assumption that individuals have the resources needed to mitigate stress. Employing a research design that selects data only related to the actual lived experience of the target population shows that this messaging is divorced from the lived reality of individuals facing resource scarcity.

PRIMARY PRESENTER

Michelle Berger

STATUS

Student – Undergraduate

AUTHOR

Michelle Berger

RESEARCH MENTOR/ DEPARTMENT CHAIR

Daina Eglitis

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Evaluating the Stability of Google Trend Parameters for Unemployment Models

Google Trend data has previously shown potential as a tool for improving unemployment forecasts across multiple developed countries. While the inclusion of the Google Trend parameter for the search term, "jobs", improved upon the baseline AR (2) model for estimating the unemployment rate in the US, this improvement was statistically insignificant. The Google Trend parameter was also found to be inconsistently significant across subsamples and to exhibit some instability in its value. An attempt to clean the data by removing irrelevant searches did not lead to improvements in either area. While Google Trend data continues to show potential as a forecasting tool, its lack of long-run stability may limit its value in real-time forecasting.

PRIMARY PRESENTER

Noah Braun

STATUS

Student – Undergraduate

AUTHOR

Noah Braun

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tara Sinclair

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Effects of Breastfeeding on Postpartum Depression and Anxiety

Postpartum depression (PPD) is a serious mental health condition that affects an estimated 13--19% of mothers, with well documented negative consequences on maternal and infant health (O'Hara & McCabe, 2013). Research has explored risk factors for PPD, including depression history and social support. However, breastfeeding as a risk factor remains understudied. Recent research has found mixed findings on the relationship between breastfeeding and PPD, in part due to varying operationalization of breastfeeding and depression. Breastfeeding difficulties may not only be due to depression but also anxiety, but anxiety has not been measured as much as depression. To address these research gaps, the present study evaluated the association between breastfeeding and PPD and between breastfeeding and postpartum anxiety. Given that depression and anxiety are highly comorbid (Austin et al., 2010), we hypothesized that there will be a negative relationship between breastfeeding and depression, and between breastfeeding and anxiety. We reviewed medical charts from 283 postpartum mothers who received OBGYN services at 6-weeks postpartum. The sample included predominantly married (58.3%), African American (46.4%) women. The Edinburg Postnatal Depression Scale (EPDS) was used to identify women with symptoms of both depression and anxiety, with higher scores indicating higher severity. Postpartum mothers were separated into two groups: (1) Breastfeeding group (n= 224), who reported breastfeeding exclusively breastfeeding or combined breastfeeding and formula feeding; and (2) Formula feeding group (n= 58), who reported exclusively formula feeding or formula feeding due to early cessation of breastfeeding. Results indicate no significant difference in depression scores between breastfeeding (M= 0.37, SD= 0.42) and formula feeding groups (M= 0.37, SD= 0.55); t(280)= -0.07, p= 0.95. There was a marginally significant difference in the anxiety subscale, in which the breastfeeding group reported having more anxiety symptoms (M= 0.87, SD= 0.66) than the formula feeding group (M= 0.67, SD= 0.72); t(280)= 1.97, p= 0.050. These findings suggest a mixed relationship between breastfeeding and PPD, and breastfeeding and postpartum anxiety. Future research should be conducted to understand the extent of comorbidity between anxiety and depression. Additionally, research should focus on the role of anxiety in PPD to understand why higher anxiety scores on the EPDS may occur for postpartum mothers who either breastfeed or formula feed their infant. Our results suggest the importance of screening for both PPD and anxiety, and encouraging mothers to make decisions about breastfeeding that are best for them to decrease risk for maternal depression and anxiety.

PRIMARY PRESENTER

Steven Chen

STATUS

Student – Undergraduate

AUTHORS

Steven Chen

Huynh-Nhu Le

Sanam Dhaliwal

RESEARCH MENTOR/ DEPARTMENT CHAIR

Huynh-Nhu Le

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Media Coverage and the Gender Gap in Political Ambition

Research has shown that the lack of women in elected office is due to a disparity in the number of women who choose to run. But little research considers whether the media environment may exacerbate this so-called gender gap in political ambition. In this project, I test whether exposure to news stories that emphasize the importance of candidates' policy expertise and public speaking ability make women less interested in running for office. This hypothesis arises from previous research that finds women often view themselves as less qualified for political office than similarly qualified men. To test the hypothesis, I draw on an original survey experiment conducted in early 2018 with a national sample of adults and a sample of college students. If the media play a role in reinforcing misperceptions that women lack the qualifications to run for office, that may help explain the persistence of gender inequality in the American political institutions.

PRIMARY PRESENTER

Kat Chevalier

STATUS

Student – Undergraduate

AUTHOR

Kat Chevalier

RESEARCH MENTOR/ DEPARTMENT CHAIR

Danny Hayes

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

A Livable City for China's Migrants in the Urban Fringe

China is expected to urbanize at a rate of 60 percent by 2018. Its unique household registration "hukou" system provides certain educational, work and social benefits to citizens based on the province their family is registered in. Urbanites in large cities like Beijing and Shanghai enjoy many benefits such as better schools, abundant and higher-paying work opportunities, and access to health care, while rural residents are left to fend for themselves. As a consequence, large numbers of rural migrant workers have moved to China's urban centers to improve their prospects. However, the barriers to entry are high in top-tier cities. Thus, many "fringe" cities (second- and third-tier) become entry points for migrants to develop networks and earn money before moving onto a larger city.

Literature has noted that urban planning policies tend to be more relaxed in fringe cities, inviting the possibility of shaping cities into thoughtfully designed, people-centric places that promote social and economic growth. The purpose of this research is to understand the link between urban planning and migrant populations. Through interviews with faculty at the George Washington University and Geographic Information Systems (GIS) analysis, this research will answer the following questions: how do Chinese urban migrants affect urban landscape, and how can cities build a livable environment that supports the economic and social mobility of migrant workers?

PRIMARY PRESENTER

Cindy Chou

STATUS

Student – Undergraduate

AUTHOR

Cindy Chou

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sophia Fisher

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

An In-Depth Look at the Experience of College Students in Mentoring Programs with Youth Who Are At-Risk in Washington, DC

Best practices have clearly been established for youth mentoring programs, and especially programs that benefit at-risk youth in the United States (Rhodes & DuBois, 2008). Although research and evaluations on these best practices demonstrate how crucial the mentor-mentee relationship is in building the resilience of at-risk youth (Adler & Trepanier-Street, 2007; Juel, 1996), not much is known about the role of the mentor, much less their experience. The purpose of this study is to answer the question: What is the experience of college students working in mentoring programs with youth who are at-risk? Using qualitative research methods, semi-structured interviews will be conducted with up to 15 college students currently volunteering or working with a program that focuses on building the academic and social-emotional skills of at-risk youth ages 3–10 years old. A constant comparative method will be used to compare across interview transcripts. Emergent themes will be uncovered using Initial and In Vivo Coding in the first coding cycle and Axial Coding in the second coding cycle. I intend to explore how the various identity factors of college students affect their roles as mentors and how they relate to their mentees. I hope this study will provide insights on college students' competencies, growth, and self-reflection in mentor roles. Although one limitation is that this study is not generalizable, this study could inform future research on the mentor-mentee relationship and the impact of mentors' identities on a mentoring program, as well as contribute to a larger body of research that informs best practices for mentoring programs.

PRIMARY PRESENTER

Danielle Ciaurro

STATUS

Student – Undergraduate

AUTHOR

Danielle Ciaurro

RESEARCH MENTOR/ DEPARTMENT CHAIR

Linda Byington

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Mommy, What Is Rape? Sexual Assault and the American Family

Though a large body of work has examined the ways in which families communicate about sex, less attention has been given to the ways in which families communicate about sexual assault. The current research examines the ways that parents talk to their children about sexual assault and related topics. In doing so, I will answer the question of how good young people feel their parents are at having these conversations, as well as whether family communication about sexual assault has any correlations with belief in rape myths. Ultimately, the goal of this research is to determine whether family communication about sexual assault may have a bearing on sexual assault prevention. This study uses a mixed methods approach, combining quantitative and qualitative data. Currently, the sample is n=59, though data collection is still underway and the sample is expected to grow to approximately n=100 before the collection period conclusion in February 2018. This paper draws on the work of Dr. Katrina Pariera (2016) and utilizes the Illinois Rape Myth Acceptance Scale (1999) to measure any correlations of belief in rape myths with family communication about sexual assault (or lack thereof). Conclusions from this study will provide further insight into how messages related to sexual assault are perpetuated. The current work will also help us to more fully understand how sexual assault is discussed at the familial level, and whether communication around this topic can be strengthened.

PRIMARY PRESENTER

Irissa Cisternino

STATUS

Student – Undergraduate

AUTHOR

Irissa Cisternino

RESEARCH MENTOR/ DEPARTMENT CHAIR

Katrina Pariera

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Designing Influence: Aesthetic Choices and Group Identity in Decorated Ceramics of Late Postclassic of Etlatongo, Oaxaca, Mexico

During the Late Postclassic (A.D. 1200–1520) in the Mixteca Alta of Oaxaca, Mexico, aesthetic qualities of ceramics were utilized as both decorative values and tools for negotiating the creation of group identities and ideologies within communities. Through a stylistic analysis of Yanhuitlan Red on Cream type ceramics recovered from excavations at the site of Etlatongo, I explore how these vessels and the motifs depicted on them were used during the creation of identity-based meanings that were easily recognized during public ceremonies. Since these ceramic types were broadly accessible and relatively abundant, I compare the frequencies of design motifs to others found on at sites throughout the Mixteca Alta, including Yucuita, Chachoapan, and within the Tamazulapan and Tepuscolula valleys. I argue that the stylistic qualities of Yanhuitlan Red on Cream wares were directly involved in dialogic social processes that promoted ideologies shared by elites and commoners within the site.

PRIMARY PRESENTER

Alexis L. Clark

STATUS

Student – Graduate

AUTHOR

Alexis L. Clark

RESEARCH MENTOR/ DEPARTMENT CHAIR

Jeffrey P. Blomster

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Perinatal Depression Screening Rates at an Urban OBGYN Clinic

Perinatal depression (PD) is a significant public health problem with negative consequences for pregnant women, mothers, and families. Given that one of the main risk factors for PD is depression that occurs during pregnancy (Field, 2011), the American College of Obstetricians and Gynecologists (2015) recommends pregnant women be screened for depression at least once in both the prenatal and postpartum periods. In 2016, an obstetrics clinic in Washington, D.C. implemented universal screening for PD, in which women are screened at their first prenatal appointment (T1), in their third trimester (T2), and at 6 weeks postpartum (T3). T3 was previously incorporated into visits at this clinic since 2014.

This study's goal is to examine the rates of PD screening since the inception of the clinic's new prenatal screening procedure. In an ongoing retrospective medical chart review (N=300 at study conclusion), data have been collected from 86 women randomly selected from ~3,000 women seen at the clinic from 7/1/2016 to 6/31/2017. Data include demographics, medical history, and referral information. The Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) was used to screen for PD, and higher scores indicate more severity of depression symptoms. High risk for PD is based on EPDS scores ≥ 10.

The sample was predominantly African-American (45.3%), married (57.0%), high school or college-educated (50.0%), employed (53.5%), and relatively young (M = 30.9 years, SD = 5.89). Of the 86 women, 41.8%, 31.3%, and 51.2% were screened at T1, T2, and T3, respectively. Women reported low depressive symptoms (T1: M = 5.31, SD = 4.30; T2: M = 5.11, SD = 3.98; and T3: M = 4.61, SD = 3.76). Women meeting high risk criteria for PD were 11.1%, 7.4%, and 11.4% at T1-T3 respectively.

Preliminary results suggest that screening for PD is not yet "universal" in this urban obstetrics setting. Less than half of the women were screened at all three time points, and only 1/3rd of all women were screened during the second trimester of pregnancy. Additional analyses of the complete dataset (N=300, anticipated by conference time) will be conducted to assess selected risk factors (e.g., history of mental illness) and current psychiatric treatment to determine whether women screened are more likely to have particular risk factors and/or receive treatment. Results from this study will enable the obstetrics program to evaluate the effectiveness of their new perinatal screening procedures and make changes to improve their system.

PRIMARY PRESENTER

Paula Cortés Campos

STATUS

Student – Undergraduate

AUTHORS

Paula Cortés Campos

Alice Barr

Madelyn Hernandez

Miriam Toaff

Jennifer Keller

Huynh- Nhu Le

RESEARCH MENTOR/ DEPARTMENT CHAIR

Huynh-Nhu Le

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Does Economic Growth Cause Democratization?

This paper explores the relationship between democracy in a country and the rate of economic growth. Initially there is no significant link between democracy and GDP growth, and, if anything there appears to be a negative association between those two variables. However, from the outset there is a statistically significant link between democracy and median years of primary education. When an instrumental variable is used GDP growth becomes significantly and positively associated with democracy. Once one establishes a direct link between the two variables, it appears that GDP growth can aid democratization especially in the long-term.

PRIMARY PRESENTER

Dana Councilman

STATUS

Student – Undergraduate

AUTHOR

Dana Councilman

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tara Sinclair

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Rape Reform and Rape Reporting: Reflections on Anti-Rape Activism and Policy Limitations

From the early 1970s to the mid-1980s, the United States underwent a massive transformation in state-level rape policy. This time period saw feminist activism lead to at least one form of policy change related to rape every single state (Spohn and Horney 1991). The widespread success feminists had in encouraging this tidal wave of policy reform has long been considered one of the greatest victories of feminist activism, and has been deemed the era of "Feminist Rape Reform."

However, numerous quantitative studies analyzing the outcomes of this reform period have shown that despite the significant amount of policy change it produced, legal outcomes for rape survivors hardly changed at all. In the years following Rape Reform, survivors were no more likely to report what happened to them to the police (Spohn and Horney 1991), police officers were no more likely to arrest rapists (Berger, Neuman, and Searles 1994), and convicted rapists were no more likely to go to jail (Bachman and Paternoster 1998). These studies overwhelmingly found that formal policy change generated in the era of rape reform was unfortunately ineffectual in improving legal outcomes for survivors of sexual violence; suggesting that policy change was an insignificant advancement towards justice if not accompanied by change in social attitudes and perceptions of rape.

In this paper, I build on existing scholarship analyzing the limitations of rape policy change, and apply this policy-critical framework to the feminist anti-rape activism of today. I conduct a quantitative analysis of the relationship between recently-passed state consent statutes using a 1–3 coding system, ranking the 'progressiveness' of each state's consent statute, and state level rates of rape reporting. My findings confirm that progressive policy changes had no impact on the likelihood of survivors to report their rape. These results indicate that even in states with the most advanced rape laws supported by activists today, survivors remain deterred from reporting by persistent shame and social stigma.

As a result, I propose a series of recommendations for modern anti-rape activists, encouraging a shift away from policy reform and towards a more substantive focus on social education and community engagement strategies first. I argue that until social attitudes towards rape and sexual violence shift, and predominant rape myths are successfully de-bunked, policy reforms accomplished in states will remain less helpful in survivors' quest for justice than activists may expect.

PRIMARY PRESENTER

Lauren Courtney

STATUS

Student – Undergraduate

AUTHOR

Lauren Courtney

RESEARCH MENTOR/ DEPARTMENT CHAIR

Cynthia Deitch

SCHOOL OF MEDIA & PUBLIC AFFAIRS

Gendered Rhetoric and its Effects in Republican and Democrat Communication

This study examines gendered content of Democratic and Republican presidential campaign ads from the 2004, 2008, 2012, and 2016 elections. This analysis attempts to distinguish between gender and sex stereotyping and measure *gender* stereotypes in partisan communication, regardless of candidate *sex*. Since gender traits apply to personality characteristics and roles, we assign them to a vast majority of things—one being language. Culturally assigned gender stereotypes have made gender a "chronically accessible" consideration for the American public in their political judgments. In particular, this analysis explores the difference in party communication styles between Republican masculinization and Democratic feminization. It examines Republican tactics to attack Democrats through feminization; while suggesting that Democrats fail to employ a counter-strategy. It furthermore distinguishes between explicit appeals to gender stereotypes, code words, and other gendered policy references. The research considers party elites, particularly candidates themselves and the official party. Prioritizing and rewarding masculine framing in politics while directly using femininity as an attack offers insights into the American electorate's values. While it is beyond the scope of this paper to suggest, even many women value masculinity over femininity, it is nonetheless an important possible political implication.

PRIMARY PRESENTER

Emily Creighton

STATUS

Student — Undergraduate

AUTHOR

Emily Creighton

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Entman

SCHOOL OF MEDIA & PUBLIC AFFAIRS

A Content Analysis of the Planned Parenthood and Center for Medical Progress Videos

Abortion is a highly contentious political issue in the United States, yet nearly one in four women will seek abortion care by age 45 (Jones and Jerman, 2017). On July 14, 2015, the Center for Medical Progress (CMP), an anti-choice organization, released a video claiming that Planned Parenthood (PP) illegally procured and sold fetal tissue for profit. This video was proven to be deceptively edited and opened the floodgates for a series of events to follow. Using coding software, MaxQDA, I will perform a content analysis on a sample of 281 news articles from network news, cable news, print media and radio that cover events important to the key developments, including video releases, lawsuits, indictments, a shooting at a PP clinic, a change in the tissue reimbursement policy, and Congressional bills to eliminate funding from PP.

The research will demonstrate that the media overwhelmingly used words that made ambiguous judgments or moral evaluations about the truth-value of the videos rather than using words that provided a clear and accurate judgment or moral evaluation. Further, the research will note the number of times the removal of government or state funds from PP is referenced, the number of times the 2016 Presidential election is mentioned in conjunction with the videos, and how PP and CMP are described as organizations by the media. I will compare my findings to a previous study (Dreier & Martin, 2010) about another community organization, the Association of Community Organizations for Reform Now (ACORN) during the 2008 election season, to see if the media fell into a similar reporting pattern of inaccurately describing the truth-value of the videos. This study will provide insight into media framing theory and how the media frames issues associated with women's health.

PRIMARY PRESENTER

Ilana Creinin

STATUS

Student – Undergraduate

AUTHOR

Ilana Creinin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Entman

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Housing as a Human Right: Analyzing the U.N. Habitat Goals for Promoting Adequate Housing

According to the United Nations, 193 countries have pledged to ensure that everyone has access to "safe, adequate, and affordable housing and essential services" by the year 2030 (De Souza 2017). However, this goal still has yet to be met, as approximately 1 billion people currently live in "inadequate housing" and approximately 100 million people are considered homeless (UN Habitat 2014). This paper examines homelessness in three major developing countries, and in doing so identifies human rights-based approaches to reducing and eliminating homelessness globally as well as using the criteria for "adequate housing" from the 2014 U.N. Habitat Report on Housing to examine the progress being made to increase access to stable, safe, and affordable housing around the world. Specifically, the paper examines the human right to housing in Sao Paulo, Brazil; Johannesburg, South Africa; and Mumbai, India, where the right to adequate housing and/or shelter is a constitutional right. To determine the effectiveness of legislating housing as a constitutional right, the case studies apply the criteria for adequate housing from the 2014 U.N. Report, specifically the criteria pertaining to legal protections, availability of services (i.e. clean water, accessible transportation and access to adequate nutrition), and protections against natural disasters. The study found that legal protections were the most compelling criteria for protecting and enforcing the right to housing. Additionally, across all three studies, it was clear that UN Habitat recognizes the economic potential of slums and the source of mobility they can generate within urban areas and the cost effectiveness of slum improvement, and as such promotes efforts improve slum dwellings globally. However, with slum improvement initiatives there is also concern that the continued emphasis on the preservation of slum dwellings in developing countries may detract from efforts to establish more comprehensive and adequate housing solutions. Ultimately, the research found that while the U.N. Report on Housing offers a comprehensive framework for addressing issues of homelessness as a violation of human rights, it is challenging to conceptualize what these recommendations will look like in each country, as every country defines homelessness differently and implements culturally specific strategies in the pursuit of different development objectives.

PRIMARY PRESENTER

Lauren Danielowski

STATUS

Student – Undergraduate

AUTHOR

Lauren Danielowski

RESEARCH MENTOR/ DEPARTMENT CHAIR

Hilary Silver

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Effects of Public Reporting on Closing the Gender Wage Gap

While there have been many advancements in women's rights over the last few decades, gender inequality in the workplace remains a significant issue. This study explores the efforts of the United Kingdom to address gender inequality in the workplace by mandating gender pay gap reporting for employers with over 250 employees. The data utilized in this study consists of the gender pay gap reports from the 673 employers that have submitted reports since the beginning of the reporting requirement in April 2017. The reports provide information on average wage differentials by gender, as well as gender distribution across wage quartiles, for each employer. In this study, we compare wage differentials across the employers utilizing indicators of commitment and comprehensiveness drawn from analyses of the reports. We conclude with a discussion of our findings and implications for managers and policy makers. The findings of this study highlight the importance of addressing gender inequalities in the workplace.

PRIMARY PRESENTER

Romy David

STATUS

Student – Undergraduate

AUTHORS

Romy David

Isabel Sabogal

Sabrina Damaghi

RESEARCH MENTOR/ DEPARTMENT CHAIR

Jonathon Mote

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Determinants of Recycling in New York City

This paper improves upon the existing literature on recycling by using measured data on diversion rates from the New York City Department of Sanitation, and socioeconomic and demographic data from the American Community Survey, at the neighborhood level. I estimate pooled and fixed effects fractional probit response models to investigate the key demographic and socioeconomic determinants of household recycling in New York City. I find that income per capita and household size have positive effects on recycling. Also, I find that the interaction between the proportion of black or African-American, but not Hispanic, and the proportion of individuals over 25 without a high school diploma in a neighborhood has negative effects on diversion rates.

PRIMARY PRESENTER

Marie-Louise Decamps

STATUS

Student – Undergraduate

AUTHOR

Marie-Louise Decamps

RESEARCH MENTOR/ DEPARTMENT CHAIR

Arun Malik

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Interculturality of La Festa dei Ceri: Gubbio and Jessup

A generally lesser-known festival, the Festa dei Ceri holds a profound meaning both for the towns of Gubbio, Italy and Jessup, Pennsylvania. Bound by a history of immigration, Gubbio and Jessup celebrate this yearly festival in honor of Ubaldo Baldassini, a Catholic saint. This tradition was brought by immigrants from Gubbio in the early 20th century to Jessup, and is still celebrated in both places to this day. Jessup's festival, however, has changed in many ways due to American culture and the different perspectives that an influx of immigrants from other countries brought. How, then, do these two towns interact, and how does each think about the Festa dei Ceri in relation to one another? Based on such prior literature as David Guss' *The Festive State*, this presentation seeks to address this question with the results of ethnographic research carried out in Gubbio under the Undergraduate Research Award during the summer of 2017. Peer observation and interviewing nearly fifty residents of Gubbio have lent to a greater understanding of the festival's significance to the town's residents, how it affects the town's culture, and how it is talked about and recalled year-round. The presentation will answer several crucial questions: what is "tradition", and how is it thought about in Gubbio? How does the dialect of Gubbio reflect the importance of the festival? Is age or gender a significant factor in conventional thought about the festival? Analysis of this data will then allow for the creation of a structure of comparison between the Festa dei Ceri in Gubbio and in Jessup in order to demonstrate ideologies, beliefs, and misconceptions that the cities hold about each other and themselves. Contributing to anthropological theory, this presentation will also consequently propose a generalized framework by which one can compare two or more cultures historically or culturally linked in ways similar to Gubbio and Jessup. The core significance of this will be to analyze and conduct research more aptly on diasporic communities, multinational or multiethnic celebrations, and relationships between "home" and "emigrant" communities.

PRIMARY PRESENTER

Angelo DeLeo

STATUS

Student – Undergraduate

AUTHOR

Angelo DeLeo

RESEARCH MENTOR/ DEPARTMENT CHAIR

Alexander Dent

SOCIAL SCIENCES

COLLEGE OF PROFESSIONAL STUDIES

Political Regimes and Twitter Communications in Sub-Saharan Africa

Focused primarily on flawed democracies, hybrid regimes, and authoritarian regimes in sub-Saharan Africa, this paper explores whether political regime affects how citizens respond to presidents on Twitter. This paper argues that citizens in flawed democracies are more likely to use civil and supportive language to respond to presidents' tweets than citizens in hybrid and authoritarian regimes. These findings suggest that political regimes, at some level, influence how citizens respond to presidents on Twitter and reflect the perception that social media's interactive capabilities have the potential to foster civic and political engagement in fragile democracies.

PRIMARY PRESENTER

Nasser Diallo

STATUS

Student – Undergraduate

AUTHOR

Nasser Diallo

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Entman

SCHOOL OF MEDIA & PUBLIC AFFAIRS

Rooting for the Home Team: Sports, Politics, and the Rhetoric of Identification

This study examines the efficacy of sports rhetoric in political communications. In particular, this research explores the influence references to local sports teams can have on voters' perceptions of politicians' relatability. Decades of scholarship provide theoretical and anecdotal attestation that sports present clear opportunities to use of Kenneth Burke's rhetoric of identification. Local sports teams form a core part of community identity, delineating between "us" and "them". Bonding over sports teams, and the values the games represent, is an easy way for politicians to establish the type of connection with citizens that is critical for persuasion. Despite this substantial body of literature, the usefulness of this kind of rhetoric has never been experimentally proven. By conducting an A/B test that compares two versions of a candidate's speech—one with local sports team references and one without—in three states known for the loyalty of their sports fans, this research paper will ascertain the political usefulness of sports rhetoric. This study is being conducted for the School of Media and Public Affairs Political Communication Special Honors Thesis under the guidance of Professors Robert Entman, Peter Loge, and Lee Huebner.

PRIMARY PRESENTER

Benjamin Englander

STATUS

Student – Undergraduate

AUTHOR

Benjamin Englander

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Entman

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Young Adults' Experiences with Sexually Explicit Internet Materials

The purpose of this study was to examine a relationship between viewing sexually explicit internet materials (SEIM) and sexual self-esteem in young adults identifying as heterosexual, gay, or lesbian. Many studies have been conducted on the association of SEIM with sexual behavior, but little research has been done on its relationship with sexual self-esteem or on females. The present study thus aimed to fill this gap in the literature by assessing the relationship between SEIM and sexual self-esteem for the different sexual orientations represented in the sample. Participants were recruited to take an online survey through Facebook. The researcher had 10 recruiters post the survey link to their accounts at the same time and day every week for one month. Data was collected on reasons why participants viewed SEIM, attitudes and reactions towards the SEIM participants had seen, and different measures of sexual self-esteem. A final sample of 188 young adults was analyzed; all participants were between the ages of 18 and 29, identified as heterosexual, lesbian, or gay, had intentionally viewed SEIM in the past, and had previously had sexual relations. The sample of lesbians collected was too small to be included in statistical analysis (n=10) and was thus excluded from the final analysis. Data analysis was completed for the remaining 80 heterosexual females, 59 heterosexual males, and 39 men who have sex with men (MSM). The current study hypothesized that: (1) males would report more SEIM use than females, (2) heterosexual males would report higher sexual self-esteem than females and MSM and females would report the least amount of sexual self-esteem,and (3) SEIM use would be negatively correlated with sexual self-esteem for females and positively correlated for heterosexual males and MSM. On average, heterosexual males and MSM reported viewing SEIM multiple times a week, while females reported only viewing SEIM 1-3 times per month. The average age for female's first purposeful viewing of SEIM was 15.73 years, for heterosexual males 13.02 years, and for MSM 13.84 years. Heterosexual males, MSM, and females reported viewing SEIM for about an hour during their typical viewing session. Heterosexual males and females reported having more sexual self-esteem than MSM. For MSM, no relationship was found between sexual self-esteem and SEIM usage; however, for heterosexual males and females, the longer they reported viewing SEIM for during a typical viewing session the lower the amount of sexual self-esteem they reported.

PRIMARY PRESENTER

Sarah Espinel

STATUS

Student – Undergraduate

AUTHOR

Sarah Espinel

RESEARCH MENTOR/ DEPARTMENT CHAIR

Paul Poppen

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Data Reporting and the Privileged Offender: A Sociolegal Comparative Look at Crimes of the Powerful

White-collar and corporate crime scholarship have historically suffered from data integrity concerns. To better understand white-collar crimes committed by privileged offenders, this paper offers a sociolegal and comparative analysis of the data generation processes of the Public Integrity Section (PIS) database, the Securities and Exchange Commission (SEC) Sanctions Database, and the National Incident-Based Reporting System (NIBRS). The purpose of this analysis is to audit the merits and limitations of these three data sources in order to account for measurement issues in studying crimes of the powerful from a legalistic—as opposed to a sociological—perspective.

PRIMARY PRESENTER

Rachel Elizabeth Fairchild

STATUS

Student – Graduate

AUTHOR

Rachel Elizabeth Fairchild

RESEARCH MENTOR/ DEPARTMENT CHAIR

Kenneth Leon

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

U.S. Politics at Work: The Impact of Leader-Follower Political Alignment

In the aftermath of the 2016 U.S. Presidential Election, the American Psychological Association has identified politics as a workplace issue on which little organizational research has been done to date. The current study helps fill this gap by examining the effects of employees' perceived political alignment (PPA) with one's leader on job satisfaction and job-related stress. PPA is defined as the extent to which employees believe their own political ideology (i.e., conservatism) to be in alignment with their perceptions of their leader's political ideology. Data was collected in an online survey, distributed to participants (n = 688) via Amazon's Mechanical Turk. Results from two moderated-mediation models indicate that PPA is positively related to job satisfaction and negatively related to job stress, such that those who felt their political ideology was more aligned with that of their leader's experienced more job satisfaction and less job-related stress as compared to individuals who felt less politically aligned with their leader. These relationships were both mediated by the quality of leader-member-exchange. Contrary to predictions, the mediated impact of PPA on job satisfaction and stress was not moderated by interest in politics, tolerance for opposing political views, or company's disclosure policies. However, our findings that the impact of PPA on job satisfaction and stress held across individuals with differing levels of general interest in politics, tolerance for diverse opinions, as well as across organizations with differing levels of acceptance of expression of political views in the workplace, suggests robust effects that generalize to many individuals, organizations and industries. Implications for how research and practice can leverage these results to address the role of national politics in workplace relations are addressed.

PRIMARY PRESENTER

Kira Foley

STATUS

Student – Graduate

AUTHORS

Kira Foley

Lynn R. Offermann

Lauren Lanzo

RESEARCH MENTOR/ DEPARTMENT CHAIR

Lynn R. Offermann

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Inequality and Altruism

Income inequality is different across countries as well as other economic, political and cultural factors. The mainly purpose of this paper was to explore the relationship between income inequality and three measures of altruism across different countries. The three measures of altruism are helping strangers, volunteering one's time to an organization and donating money. Data of this paper are mainly from Gallup World Poll and World Bank Development Indicator. First, this paper finds that people living in more unequal countries are more likely to choose volunteering their time to an organization and helping strangers rather than donating money as their charity behavior. Becker's time allocation model has been used to interpret this result. Second, this paper also verifies previous literature that welfare states have no crowd out effect on charitable giving from the coefficient of a public total expenditure regressor. Third, this paper using country-level data verifies individual-level studies that donating money and volunteering one's time to an organization are complements. Further studies are needed for data integrity and to investigate the effects of internal remittances and tax deduction on charitable giving across countries.

PRIMARY PRESENTER

Zhenghuang Gao

STATUS

Student – Undergraduate

AUTHOR

Zhenghuang Gao

RESEARCH MENTOR/ DEPARTMENT CHAIR

Bryan Boulier

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

An Examination of the Lived Experiences of Filipino Domestic Workers in Turkey

A number of Filipinos struggle to find work with a living wage in the Philippines and thus feel compelled to go abroad as domestic workers, often experiencing pain, abuse, loneliness, isolation and trauma (Arguillas, 2010) (Lai, 2011). The silent cries and screams of Filipino domestic workers are muted, and thus remain as deep wounds for Filipinos in certain areas of the globe (Ladegaard, 2014). As migration brings a number of psychological as well as sociological struggles, the purpose of this study is to explore and more fully *understand* the Filipino domestic worker experience in Turkey. The study will consist of qualitative in-depth one-on-one interviews with Filipino domestic workers who have had at least a 6-month working experience as a domestic worker in Turkey. Data will also be collected through observing weekly meetings held at the St. Spirit Cathedral Harbiye Church, where Filipino domestic helpers are invited to share and discuss their stories and experiences in a non-threatening environment. Data that will be emerged from the interviews and observations will be coded with themes developing from the analysis as well as from recurring themes from existing literature and research. This research intends to contribute to the gap in literature regarding the understanding of the Filipino domestic worker experience in Turkey. The findings may help inform those (e.g., non-profit organizations, migrant workers, employers) who seek to help close the divide between employers and workers. It may also offer some insights to mitigate stereotypes and to improve working relationships, due to what appears to be a repetitive cycle of power dynamics between the employer and worker, by more fully exploring the lack of communication between both parties.

PRIMARY PRESENTER

Natalie Garih Herzikowitz

STATUS

Student – Undergraduate

AUTHOR

Natalie Garih Herzikowitz

RESEARCH MENTOR/ DEPARTMENT CHAIR

Linda Byington

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Creating Criminals: Exploring the Impacts of U.S. Immigration Policy on the Children of Latino Immigrants

As the first stage of a larger project, exploring how tightening U.S. immigration policies impact the assimilation of Latino youth into U.S. society, this paper empirically looks at factors that increase the likelihood of arrest among immigrant children. Utilizing theoretical perspectives from Jane Addams and Erving Goffman on ethics and stigma, I consider the correlation between these findings and trends in immigration policies. I conclude by discussing recommendations to limit the negative impact of these policy changes.

Using a historical perspective and open source data, this paper investigates the consequences of changes following the Immigration Reform and Control Act of 1986. The data for assessing life courses of Latino youth are from three phases of the Children of Immigrants Longitudinal Study conducted by Alejandro Portes and Rubén Rumbaut (1992-2006). Whether the respondent has been arrested by the time of the final wave of the study is used as an indicator of engagement in delinquency and by extension of problems assimilating into U.S. society. Maximum-likelihood logistic regressions were conducted using new variables created for this analysis, producing odds ratio coefficients.

The most notable results are that arrest rates correlate most significantly with the variables for gender, crime victim, Latino, family arrest, and discrimination.

My paper concludes by first, discussing explanations for these correlations, drawing on Addams and Goffman; second, arguing that recent trends in immigration policy may intensify the effect of these variables by negatively framing this population, and third, suggesting policy changes to mitigate the consequences.

PRIMARY PRESENTER

Jacqueline Groccia

STATUS

Student – Undergraduate

AUTHOR

Jacqueline Groccia

RESEARCH MENTOR/ DEPARTMENT CHAIR

Daniel Martinez

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Characteristics of Informal Workers in Urban China

To build upon existing literature, this paper strives to determine the characteristics that make workers in urban China more likely to participate in informal labor using data from the Chinese Household Income Project 2013 survey. The data is examined using four logit regression models looking specifically at gender, ethnicity, age, education level, and household (hukou) registration status. These regression models indicate that informal workers in urban China are more likely to be young, female, have low levels of education, and be a rural hukou holder. The paper focuses solely on this goal in order to deliver valid and consistent results determining the makeup of China's informal sector in hopes of informing future research.

PRIMARY PRESENTER

Anne Hardee

STATUS

Student – Undergraduate

AUTHOR

Anne Hardee

RESEARCH MENTOR/ DEPARTMENT CHAIR

Bryan Boulier

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Alexithymia and Psychological Defenses: A Meta-Analysis

A meta-analysis was conducted to determine the association between alexithymia and psychological defensiveness, and to assess the influence of the psychological maturity reflected in the defense type indexed by each effect size included in the analyses. An exhaustive search of the literature yielded a total sample of 22 studies that contributed 60 independent effect sizes. Analyses using both fixed-effects and random-effects models obtained moderate positive associations between alexithymia and overall defensiveness (*rs* = .22; .20) as well as between alexithymia and neurotic defenses (*rs* = .33; .30). A strong positive association was obtained between alexithymia and immature defenses (*rs* = .55; .54); a moderate negative association was observed between alexithymia and mature defenses (*rs* = -.34; -.30). These findings held when effect sizes indexing the three defense styles corresponding to maturity level were analyzed separately. Moderator analyses indicated that both participant diagnostic classification and defense style maturity influenced the magnitude of the effect between alexithymia and defensiveness. These findings are consistent with previous literature in which alexithymia is thought to involve defensive operations that reflect use of archaic psychological processes.

PRIMARY PRESENTER

Madeline A. Huffstickler

STATUS

Student – Graduate

AUTHOR

Madeline A. Huffstickler

RESEARCH MENTOR/ DEPARTMENT CHAIR

Catherine Cottrell

GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Persons with Autism Spectrum Disorder (ASD): Enhancing Employment Opportunities Through Exploring Agriculture-Based Job-Training and Employment

According to the 2017 National Autism Indicators Report, while one in four adults with autism spectrum disorder (ASD) have the goal of working in community employment, only 14% currently achieve that goal. In order to bridge the gap between those numbers and offer the other numerous psycho-social, physiological and financial benefits of employment to persons with ASD and other disabilities, several agricultural job-skills training programs have been started on the national and state-level. However, while in the state of Virginia alone, agriculture is a $70 billion industry, accounting for 334,000 jobs state-wide, persons with ASD struggle to find steady employment in this field. This research focuses on Phase 1 of a three-phase research proposal, which includes community-based research with Virginia farmers, persons with ASD, and those in the vocational training field. Phase 1 includes a review of the current state of the field of agricultural-based job-training and employment for persons with ASD, including current accessibility, training and employment practices, and benefits of and barriers to this type of employment. Through the review of literature and conducting of interviews with individuals in the field, this research phase is aimed at providing a better understanding of current practices, with the broader purpose of furthering the project goal of shaping community-informed best practices for future training and employment for persons with ASD in agriculture and agriculture-related fields.

PRIMARY PRESENTER

Katherine B. Hurley

STATUS

Student – Graduate

AUTHOR

Katherine B. Hurley

RESEARCH MENTOR/ DEPARTMENT CHAIR

Maureen McGuire-Kuletz

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Perceived Impact of Community Nonprofit Leaders on Crime in Washington, D.C.

Due to trends in the fields of Public Administration and Philanthropy, nonprofit organizations have been incentivized to spend a large amount of resources measuring program effectiveness, in order to remain competitive in the grant seeking process. Based on existing literature, I argue that this emphasis on accountability and impact in the nonprofit sector is at its root an indicator that government agencies and grant makers alike are unsure that nonprofit organizations serve their function in reducing the prevalence of social issues. This study is grounded in the revolutionary findings of Sharkey, Torrats-Espinosa, and Takyar (2017) who have demonstrated that on a city-wide scale simply the presence of certain categories of nonprofit organizations decreased the violent crime rate. The purpose of this study is to examine the way community nonprofit leaders in Washington, D.C. understand their influence on reducing crime in D.C. Semi-structured interviews will be conducted to examine the role nonprofit leaders believe they may have played regarding crime reduction. Employees working for nonprofit organizations, classified by the National Taxonomy of Exempt Entities as either a crime prevention organization, a neighborhood development organization, or a substance abuse program in the District of Columbia (NTEE) are currently being recruited for this study. These interviews will be recorded, transcribed, and coded for analysis.

PRIMARY PRESENTER

Olivia Idris

STATUS

Student – Undergraduate

AUTHOR

Olivia Idris

RESEARCH MENTOR/ DEPARTMENT CHAIR

Linda Byington

SOCIAL SCIENCES

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Quantifying and Evaluating Qualitative Forecasts Made by the Bank of England: A Textual Analysis Case Study

This paper evaluates qualitative estimates of output growth released by the Bank of England in its inflation reports between 2005 and 2014. Building on previous literature, a textual analysis procedure is used to convert the qualitative assessments made by the Bank into quantitative scores. In order to determine how well these assessments reflected the true state of the United Kingdom economy, the scores are compared to real-time output growth data over the specified period. We find that the qualitative nowcasts made by the Bank of England correlate highly with output growth in the quarter of publication. Similarly, the qualitative forecasts correlate highly with output growth in the next quarter. On the whole, this suggests that developments in the United Kingdom economy were accurately represented in the text of the inflation reports. With regard to turning points, the results indicate that the Bank failed to forecast the onset of the Great Recession ahead of time. However, the Bank did perceive underlying weakness in the economy prior to the downturn, and did recognize its severity once it had begun.

PRIMARY PRESENTER

Jacob Jones

STATUS

Student — Undergraduate

AUTHOR

Jacob Jones

RESEARCH MENTOR/ DEPARTMENT CHAIR

Herman Stekler

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Minimum Wage and Women's Decision-Making Power Within Households: Evidence from Indonesia

While the importance of female empowerment and gender equity for development outcomes is well understood and existing theory on the household predicts that the labor market environment plays a key role in household bargaining, there is very little empirical research studying the role of broad labor market policies on female empowerment in developing countries. We address this by estimating the effects of minimum wage policy in Indonesia. Using province-specific minimum wage increases in Indonesia from 2000–2014 and data from a panel of Indonesian households, we implement a method that exploits differences in minimum wages between geographically proximate districts located near the border between separate provinces. Consistent with existing theories on household decision making, we hypothesize that minimum wage increases affect the household decision making process through their heterogeneous effects on male and female labor market outcomes. We document that the minimum wage has a positive and significant effect on labor force participation and overall earned income for married men but does not have a statistically significant effect for married women. As predicted by household decision making theory, we find a negative and significant effect of minimum wage on the wife's role in making decisions related to household resource allocation.

PRIMARY PRESENTER

Jin Ho Kim

STATUS

Student – Graduate

AUTHORS

Jin Ho Kim

Benjamin D. Williams

RESEARCH MENTOR/ DEPARTMENT CHAIR

Roberto Samaniego

SCHOOL OF MEDIA & PUBLIC AFFAIRS

The Death Spiral: Media Behavior and ACA Myth

This research examines the popular myth that the Affordable Care Act exchanges have entered a "death spiral" by considering a sample of news segments from FOX News, CNN and MSNBC and a sample of articles from The Wall Street Journal, USA Today and The New York Times. By employing a viewership ideology measure of outlet orientation and analyzing outlet willingness to accept, remain neutral or reject the death spiral myth, this study seeks to confirm what relationship, if any, media outlet orientation has to death spiral myth response. In the tradition of political communication research which has established a relationship between political power and media narratives, this study will scrutinize the frequency with which certain types of actors introduce the death spiral myth. Finally, this study will evaluate the rise of the death spiral myth, looking at data from January 2016 to January 2018, and survey the political landscape in order to better elucidate what events may have precedes in myth appearance. The research finds that media outlet orientation corresponded significantly with myth response across studied outlets. Moreover, the data shows that politicians are the most common purveyor of the death spiral myth. Finally, the data suggest that the myth rose not with any notable use by a Republican politician but near the inauguration of Donald Trump, though a causal link is not established. Overall, the findings suggest that the media behavior in the wake of the death spiral myth, like most political communication, is subject to the forces of political power and partisanship.

PRIMARY PRESENTER

Joshua Kirmsse

STATUS

Student – Undergraduate

AUTHOR

Joshua Kirmsse

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Entman

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

A Sociological Case for Community Resilience: A Tool to Mitigate the Effects of Natural Disasters

We live in a time where extreme weather events pose a persistent threat as they increase in volatility. Those who are hit the hardest by natural disasters are the most socially vulnerable populations, presenting a complex challenge. While we often look to technology to solve today's problems, we underestimate the capacity of the community. When an area is devastated by a drought, hurricane, or earthquake—how can we maximize the power of the people in order to save lives and reduce harm? The concept of *community resilience* has become a buzzword in a number of disciplines as a potential means to do so. This kind of resiliency goes beyond the engineering of infrastructure and disaster predictor technologies. It is embedded in the individual as well as the group; considered to be a set of capacities that has the possibility of preparing populations for the unimaginable and establishing networks that can speed recovery and relief. By placing this concept within a Sociological framework, we can identify the social factors at play. Social vulnerabilities that will be identified encapsulate social, economic, and the institutional factors. Through empirical research, ways to leverage adaptive capacities to environmental disasters can be understood. This thesis seeks to illuminate vulnerability as a Sociological phenomenon, and to produce an assessment of so-called community resilience that can be utilized by community stakeholders themselves. In maximizing community resilience, localities take on proactive attitudes to disaster planning and management in a way that can engage structures (government and institutions) as well as agents (individual community members). Resilient communities reap the benefits of boosted community outcomes, particularly among underprivileged populations.

PRIMARY PRESENTER

Elizabeth Lane

STATUS

Student – Undergraduate

AUTHOR

Elizabeth Lane

RESEARCH MENTOR/ DEPARTMENT CHAIR

Daina Eglitis

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Race, Gender, and School Discipline: African American Girls' Experience in District of Columbia Public Schools

School disciplinary policies are an integral component of school inequality. Prior research has primarily focused on the disproportionate rates that African American boys are punished. Therefore, this article will address the discipline of African American girls. A focus group of African American girls who are enrolled in Washington, DC public schools will be used to determine the qualitative experiences of students. Data will be coded and analyzed to yield the students' own perspectives of 1) How African America girls are being disciplined and 2) How such discipline affects African American girls' wellbeing. As a result, this study will focus on a largely untapped source of feminine narratives that can be used to enrich existing school discipline research.

PRIMARY PRESENTER

Tia Lewis

STATUS

Student – Undergraduate

AUTHOR

Tia Lewis

RESEARCH MENTOR/ DEPARTMENT CHAIR

Emily Morrison

SOCIAL SCIENCES

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Gender Diversity in the U.S. Environmental Sector: Where We Stand and the Road Ahead

Current literature suggests that organizations with gender diversity can be positively associated with greater transparency within the organization and overall effectiveness. This study aims to explore the presence and impact of women in leadership positions in three different aspects of the environmental sector in the United States: federal environmental agencies, non-governmental organizations, and local governments. Adapting and modifying the methodology of the *Global Women's Leadership Initiative* by the Women in Public Service Project, data from a 10-year period was collected for all 5 US federal environmental agencies, the top 10 non-governmental organizations based on total revenue, and the local government of the 5 most populous cities in the United States. Specifically, this study will seek to compare the presence of women leaders across the three different parts of the environmental sector, the relationship that exists between pathways to leadership, and the relationship between gender diversity and the policies and initiatives undertaken by each organization. The goal of these findings is to contribute to the ongoing research of gender diversity in the environmental sector and highlight the positive impact women leaders have on policy, initiatives, and the challenges they face to reach these positions.

PRIMARY PRESENTER

Jacqueline Lopez

STATUS

Student – Undergraduate

AUTHOR

Jacqueline Lopez

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert W. Orttung

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Differences in Asian Family Values and Suicide Ideation Between Asian American and Asian International College Students

Suicide has been one of the leading causes of death among both Asian populations and college students. However, there is a lack of literature on potential risk factors for suicidality among both Asian American (AA) and Asian International (AI) individuals in university settings. Based on the limited literature, researchers have found that the pressures to uphold family or cultural values could be a possible risk factor for suicide ideation among the Asian population. Although findings have been mixed, some researchers have found that high levels of acculturation are associated with increased levels of suicide ideation. This study aims to examine differences in Asian family values and suicide ideation between AA and AI college students. It is hypothesized that (1) AI students will have higher levels of Asian family values than AA students and (2) AI students will have lower levels of suicide ideation than AA students.

Participants were AA and AI college students recruited through different platforms including psychology student research pools, listservs, social media, organization meetings, churches, public locations in Asian communities, and direct contacts through snowball sampling to complete a survey hosted by Qualtrics. This specific study focused solely on Asian family values and suicide ideation between the AA and AI groups.

Based on independent sample t-tests, AA college students do not differ with AI college students with regards to Asian family values as well as suicide in the past month or year, thus rejecting both the study's hypotheses. There was also no significant correlation found between Asian family values and suicide in the past month or year for both groups.

Since there have no previous studies on the comparison between Asian American and Asian International students, it is hard to say whether these comparisons are consistent with previous studies. However, future studies could use different measures related to family or cultural values and especially acculturation to see if results would be different from the current study.

PRIMARY PRESENTER

Linsey Mathew

STATUS

Recent Alumni

AUTHORS

Linsey Mathew

Alexandria Huh

Nir Liebenthal

Sherry Molock

Makiko Watanabe

Amrisha Prakash

Dave Jean

RESEARCH MENTOR/ DEPARTMENT CHAIR

Sherry Molock

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Trauma and Stress Among Central American Immigrants Living in Langley Park, Maryland

Central Americans from Guatemala, El Salvador and Honduras represent one of the largest growing populations in the Washington D.C. metropolitan area (Krogstad & Keegan, 2015; Zong & Batalova, 2015). As the U.S. population grows more diverse, the health and wellbeing of migrant populations becomes more important in the understanding of global public health and related policies. Nonetheless, the breadth information about the health issues and vulnerabilities related to transnational migration is still narrow, particularly in the context of Central American migration. This investigation seeks to better understand the sociocultural circumstances that surround Central American migration to the U.S. and how those conditions influence the mental health of the population studied. Specifically, the study explores the occurrence of stress and experience of traumatic events, considering Central American immigrants' life history in their country of origin, their migration experience, and their ability to adjust to living in the United States. This exploratory, qualitative-quantitative investigation analyses a total of 75 migration-focused life history interviews, collected in Spanish in Langley Park, MD. The study population is composed of 59% female and 41% male participants between the ages of 18 and 57. A minimum of 10 follow-up interviews with immigrant community leaders in Langley Park will be collected, focusing on cultural expression and understanding of stress and trauma. The potential for psychological stress is high in each segment of migratory transition. The two primary reasons for leaving respondents' home country are to escape violence victimization, and poverty. Those escaping violence have fled from gang violence, domestic violence, or discriminatory violence. More than two-thirds of respondents experienced migration stress, including experiencing or witnessing violence or sexual assault, imprisonment for ransom, temporary incarceration, and difficulties crossing the Mexican desert. Almost half experienced health problems during migration. Most respondents face difficulty adjusting to life in the U.S. due to high living costs, insecurity due to the current political climate, lack of doctors nearby, language barriers, and lack of social support. Despite the hardships, most participants cite work opportunities, better safety, and access to schools and transportation as positive components of living in the United States. This pilot study will lay the groundwork for important future research on the social determinants of health among Central American and other non-Latino immigrant populations. Additionally, this research will serve as a reference for larger-scale epidemiology studies regarding Central American immigrant stress and PTSD.

PRIMARY PRESENTER

Rosalie Mattiola

STATUS

Student – Undergraduate

AUTHORS

Rosalie Mattiola

Mark Edberg

Leonardo Flores Andrade

Ivonne Rivera

Jorge Benavides

RESEARCH MENTOR/ DEPARTMENT CHAIR

Mark Edberg

SCHOOL OF MEDIA & PUBLIC AFFAIRS

Explaining Fake News: How Cable Television News Cover the Fake News Epidemic in the United States

This study examines the coverage of fake news by American mainstream cable news outlets from October 2016, when the issue of fake news gained national attention, to October 2017. Fake news is defined as blatantly false, baseless stories spread as fact-based news. I employ a content analysis of cable television news transcripts found on *LexisNexis*. I analyze transcripts from CNN's *Erin Burnett Outfront, Anderson Cooper 360°, CNN Tonight with Don Lemon,* Fox News' *Special Report with Bret Baier, Tucker Carlson Tonight, Hannity,* and MSNBC's *All In with Chris Hayes, The Rachel Maddow Show,* and *The Last Word with Lawrence O'Donnell*. The study codes television transcripts based on explicit definitions of fake news, discussions of media literacy, affirmation or rejection of President Trump's definition of fake news, ties to Russia, mentions of misinformation, mentions of denial, and mentions of danger. I find that the mainstream television news media are not offering consistent, clear definitions and explanations of fake news.

PRIMARY PRESENTER

Jillian Nystedt

STATUS

Student – Undergraduate

AUTHOR

Jillian Nystedt

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Entman

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Demography and the Marginal Propensity to Unionize

Unions advocate for fair employee pay standards and workplace protection: unions can be regarded as a symptom of disequilibrium between the wages workers seek and the wage offered by an employer. Unions serve as powerful institutions for the alleviation of discriminatory workplace practices through the creation of a collective voice for disenfranchised communities. Although union membership offers advantages for workers from marginalized occupational and demographic communities, in the past years overall union membership as a percentage of the U.S. workforce has declined; namely, private sector union membership has declined significantly over time, while public sector union density has remained fairly constant (BLS, 2016).

This analysis explores the interrelation between demographic and occupational characteristics and private sector union membership. Private sector union organizers are concerned with developing targeting strategies to reduce attrition rates and recoup membership losses. This paper acknowledges the positive contribution that unions provide to marginalized individuals; thus, the idea supporting this analysis is that considering member profiles and their role in an individual's decision to unionize might benefit union organizers' recruitment efforts. Positive, significant results would suggest union organizers target their recruitment efforts toward individuals that have a greater propensity to unionize given demographic and occupational profiles.

Using 2013-2016 data taken from the Current Population Survey (CPS), this study investigates the marginal propensity to join a private sector union given personal profile characteristics. Time trends between demographic and occupational characteristic (*levels*) are first plotted using historical CPS data during the period 2000-2016. The historical trends reveal that union membership levels are highest for black men, individuals ages 45–64, and those in the transportation industry. To empirically test that these trends exist at the margin, a multidimensional logistic regression is employed to underscore the individual propensity to join (or not join) a private sector union. Demographic measures include race, sex, and age and are included first as explanatory variables, and occupational characteristics—occupation/industry—are added subsequently. Based on the observed CPS data trends, I hypothesize that the results of this analysis will be consistent with the historical *level* results of the data and confirm that there exists a significant, positive propensity to unionize for black men, individuals ages 45–64, and those in the transportation industry.

PRIMARY PRESENTER

Chinemelu Okafor

STATUS

Student – Graduate

AUTHOR

Chinemelu Okafor

RESEARCH MENTOR/ DEPARTMENT CHAIR

Ronald Bird

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Understanding Resilience in Human Services Professionals

In the field of human services, professional proficiency is dependent on more than delivery of tangible services. Human services sector jobs often require caseworkers and practitioners to develop a certain level of quality, strength, and depth of relationship with clients, in order to effectively deliver services. In order to build these relationships, professionals may have to engage with their clients' trauma in some way (Argentero & Setti, 2011). This engagement can require emotional heavy-lifting for the professional, and cause emotional and psychological strain. In the face of such potential for developing burnout symptoms, it is imperative for human services professionals to learn how to cultivate resilience.

Utilizing in-depth, semi-structured interviews with up to 10 human services professionals across industries, this study seeks to understand: the methods and practices that are being used in the field to cultivate resilience; motivating factors for professionals to stay in the field; and finally to provide a platform for professionals to share their lived experiences.

This study will examine the lived experiences of human services professionals who deliver direct services to clients experiencing some form of trauma. There is an emphasis on practitioners who deal with trauma because of its implications on the psyche of both the sufferer and the care provider. Thus far, there is a strong indication that years of experience, clarity of job expectations, mentorship and organizational support heavily impact a professional's ability to withstand the emotional toll of their work. The results of this study have implications for how we realistically prepare people for the field of human services.

PRIMARY PRESENTER

Nkechi Okoronkwo

STATUS

Student – Undergraduate

AUTHOR

Nkechi Okoronkwo

RESEARCH MENTOR/ DEPARTMENT CHAIR

Linda Byington

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Events and Processes: Interpretations and Histories of the Global Slave Trade

As one of the first truly global process in recorded history it can be said that the African slave trade from the 15th to the late 19th century laid one of the cornerstones of modernity. Continents, capital, and people were linked together in an entangled web of networks driven by this trade in a manner never seen before. This presentation will offer insight into how the Slave Wrecks Project is approaching this task through an approach that draws upon theoretical and methodological approaches from history, archaeology, and anthropology. My research has focused on how maritime archaeological and historical research, which is producing a focused picture of an "event"—the last voyage and wrecking of the slaver Sao Jose in 1794—is vastly enriched when placed into the broader processual context, that can be provided by the types of historical archaeological research which is also being conducted in the locations connected by this global story. In this presentation I will discuss the archaeological work that is being conducted at a port of slave embarkation in East Africa—Mozambique Island. In the summer of 2017, a team of archaeologists conducted research on Mozambique Island, and uncovered a site that we believe was part of a trading port from which enslaved Africans—along with other materials—were likely traded for centuries. Archaeological evidence of a ramp structure mirrors what has been documented at a number of other comparable sites elsewhere on the East African coast. Spanning a timeframe that actually predates European presence, the material evidence collected (inclusive of Chinese porcelains, glass beads, Sassanid pottery from the Levant, etc.), indicates a long-term history of control and investment in global trading that would have initially been Indian Ocean oriented before eventually encompassing a Transatlantic component. My contribution will focus on how describing how specific events and micro-histories of an event of the Sao Jose produce a powerful type of narrative, while excavation such as the one launched last year helps us understand a process—such as global commerce—by presenting a context that moves through space and time. In other words, an excavation may not show or tell one specific story, but provides evidence through space and time. By utilizing narratives (events) like the Sao Jose, alongside processual histories uncovered by excavation, we may produce new ideas of the slave trade, and its implications today.

PRIMARY PRESENTER

Diogo Oliveira

STATUS

Student – Graduate

AUTHORS

Diogo Oliveira

Stephen Lubkemann

RESEARCH MENTOR/ DEPARTMENT CHAIR

Stephen Lubkemann

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Experience of Law School Students in Law School Legal Clinics

Shananhan, Selbin, Mark, and Carpenter (2017) have described in their study entitled "Measuring Law School Legal Clinics" that there has been extensive literature written on law school legal clinics, most of which outline what the outcome of participating in a law school clinic should be. Much of the literature has agreed that the two primary outcomes are: 1) law students gain practical legal skills and 2) clinic participation encourages commitment to taking on pro bono cases in their later legal careers. However, most of the studies largely neglect the student voice and do not touch on what the outcomes of clinic participation actually are, from the student prospective.The question this study seeks to answer is: what is the experience of law school students in law school legal clinics? This study will explore this question and other possible outcomes by interviewing law students who either are currently or recently have participated in their law school's legal clinic. Approximately ten students from two different Washington, D.C. law schools will be interviewed using a semi-structured interview format. The law schools selected for the study have different legal clinic structures, clinic participation as a graduation requirement and voluntary clinic participation. Thus far, the data, though preliminary, has revealed that law students who participate in law school legal clinics have an increased commitment to social justice issues and see the value in the practical education found in law school legal clinics. It is too soon to tell whether or not voluntary participation versus required participation has an effect on these outcomes.

PRIMARY PRESENTER

Jennifer Pacicco

STATUS

Student – Undergraduate

AUTHOR

Jennifer Pacicco

RESEARCH MENTOR/ DEPARTMENT CHAIR

Emily Morrison

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Socio-Economic Status as a Predictor of Sexual Behaviors Among Latino Immigrant MSM and Their Sexual Partners

BACKGROUND

Sexual risk for HIV is stratified by sexual role and activities, particularly presenting a higher risk for receptive partners due to biological vulnerabilities. Sexual role-based identity among Latino men who have sex with men (MSM) often coincides with assumptions regarding power dynamics between sexual partners. Latino MSM often associate *pasivo* (receptive) roles with less power in the dyad whereas *activo* (insertive) roles are associated with more power. A more granular understanding of the role socio-economic status (SES) plays in power dynamics, and thus HIV risk, is warranted given the identity-based oppression faced by Latino MSM. Our study aimed to explore the implications of SES for sexual activities among Latino immigrant MSM.

METHODS

Our sample included 350 Brazilian, Colombian, and Dominican immigrant MSM residing in New York City. We estimated SES differential using participants' responses on questions gauging their sex partner's education and income compared to their own. We categorized SES as favoring the participant, the partner, or equal between partners. Participants also reported their participation in a series of sexual activities during the most recent sexual encounter with a single partner.

RESULTS

Regarding SES differentials, 24% of participants had a higher SES than their partner, 40.9% had a lower SES, and 35.1% reported equal SES. A series of logistic regressions revealed that, as compared to participants with higher or equal SES, participants with lower SES than their sexual partner were more likely to receive oral sex and manual stimulation of their penis and anus by their sexual partner. They were also less likely to penetrate or ejaculate in their partner's anus. They were not more or less likely to receive anal penetration or ejaculation in their anus from their sexual partner.

CONCLUSIONS

Although participants with lower SES were more likely to receive oral and manual stimulation, it did not confer an increased risk of HIV through receptive anal intercourse. The conceptualization of dyadic power between *activo* and *pasivo* partners was not aligned with SES. To minimize the influence of SES on HIV risk, user-controlled forms of protection such as PrEP may be more of an acceptable option for Latino immigrant MSM.

PRIMARY PRESENTER

Ben Parchem

STATUS

Student – Graduate

AUTHORS

Ben Parchem

Ana Maria del Rio Gonzalez

Andrew Barnett

Maria Cecilia Zea

RESEARCH MENTOR/ DEPARTMENT CHAIR

Maria Cecilia Zea

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Scenes from the Plains of Akka: Politics and Dynamic Landscapes in the MBA Western Galilee

By examining regional studies of history and archaeology through broad geographic lenses and by attempting to identify interregional concepts and themes scholars can derive more comprehensive and wholistic conclusions about particular sets of data. The Western Galilee region of the Southern Levant stretches from the plains around Akko to the adjacent and integrated Galilean highlands to the West; constituting one of Horden and Purcell's (2000) unique 'micro-ecologies,' the Western Galilee contains its own environment and unique conditions of settlement. Current historical and anthropological interpretations of the settlement and politics of the Western Galilee in the Middle Bronze Age are founded on a few problematic principals. Looking closely at the sites of Tel Kabri and Tel Akko, this paper reexamines the Middle Bronze Age narrative of the palatial kingdoms of Western Galilee and suggests instead a more dynamic examination of palace, kingdom, and the relationship between urban centers and the landscape around them. The study of early complex societies often problematically treats and identifies the early State in prehistory. This paper will critique the methodologies of extrapolating politically integrated kingdoms, question the 'palatial' interpretation of the urban centers, and then approach the landscape and site distribution of the Western Galilee from a more critically engaged perspective using a more appropriate network-style model. Settlement sites in a particular political landscape are liminal entities and elements of diverse multiscalar processes carried-out by active agents of social and political change. These mechanized changes are manifested in fluid and dynamic landscape relationships. Finally this paper applies the updated model to understand the functions of the Tel Kabri palace in the local political economy and finds inter-Mediterranean analogs in the Aegean.

PRIMARY PRESENTER

Samuel DeWitt Pfister

STATUS

Student – Undergraduate

AUTHOR

Samuel DeWitt Pfister

RESEARCH MENTOR/ DEPARTMENT CHAIR

Eric Cline

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Effects of Ethnicity on American Children's Attitudes About Mental Illness

Approximately 44.7 million adults in the United States experience mental illness in a given year. Yet in 2016, only 43% of those adults suffering from a mental health condition received mental health services (SAMHSA, 2017), largely because of the negative stigma associated with mental illness in the United States. Culture also plays an indisputable role in the conversation about mental health, reflected in the differences in prevalence of mental disorders, attitudes towards mental illness, and the subsequent utilization of mental health services among various racial and ethnic groups (Asnaani, Richey, Dimalite, Hinton, & Hoffman, 2010, SAMHSA, 2015). Half of all chronic mental illness begins by age 14, three-quarters by age 24 (Kessler, Chiu, Demler, & Walters, 2005). Therefore, it is in the interest of children, families, and future generations to attempt to better understand the formation of mental health stigma among children.

To further investigate the relationship between race/ethnicity and stigmatization of mental illness among American children, this study recruited 37 children age 9 to 11 from a variety of organizations such as YMCAs, community centers, and extracurricular programs in Washington, D.C. and Massachusetts. Participants read two short stories about hypothetical classmates exhibiting signs of either depression or conduct disorder, two of the most commonly diagnosed mental disorders among children. With a parent's consent, participants then filled out a questionnaire that was adopted from the Mental Health Commission of Canada's Opening Minds initiative (MHCC, 2013). The questionnaire used a Likert scale to measure implicit stereotyped attributions and social tolerance regarding individuals with a mental disorder. Each item was given a score of 1 to 5 in such a way that higher scores indicated greater levels of stigmatization. Stigma scores combined stereotype and social tolerance scores. Parents filled out a demographic questionnaire, listing the child's race/ethnicity and his or her exposure to mental illness within the immediate family. Preliminary analyses on this sample indicated that mean stigma scores were statistically significantly greater for the 25 participants belonging to a minority group ($M=3.19$) than for the 12 European Americans ($M=2.67$, $t(37)=2.95$, $p<.01$). These results highlight the need for culturally specific strategies for combatting mental health stigma among American children. Further data collection is currently still in progress.

PRIMARY PRESENTER

Shaylyn Quinn

STATUS

Recent Alumni

AUTHOR

Shaylyn Quinn

RESEARCH MENTOR/ DEPARTMENT CHAIR

Peg Barratt

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

Fintech and Financial Inclusion: An Analysis of Brazil

Fintech has become a ubiquitous buzzword, but there is little literature on their role in the financial market in upper-middle income countries. The Brazilian fintech market is experiencing a boom as new fintechs emerge and banks invest in their own technologies with promises of a better customer experience. This paper uses regression analysis to examine whether Brazilian fintechs impact financial inclusion through the mechanism of lower interest rates. The paper uses two regressions and finds that the presence of fintechs has a significant negative relationship with financial inclusion but that this relationship is not economically meaningful; the founding of one fintech sees a decrease of 6,000 active financial relationships. The paper finds that fintech interest rates do not significantly differ from traditional bank rates, but trends in the data demonstrate that fintechs charge higher interest rates. This indicates that fintechs are gaining traction with consumer because of convenience and ease of use, rather than price.

PRIMARY PRESENTER

Giulia Ricca

STATUS

Student – Undergraduate

AUTHOR

Giulia Ricca

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tara Sinclair

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Evaluating Forecasting Processes of the 1937–1938 Recession: A Quantitative Analysis of U.S. Economic Agents' Qualitative Assessments

Previous examinations of the outlook of U.S. economic agents during the first wave of the Great Depression (1929–1933) have determined that the private sector's forecasts were consistently over-optimistic in their assertions that the downturn would end, even as it worsened. This paper builds upon the existing literature by investigating whether the business community learned from these forecasting mistakes. This is achieved via an analysis of the second wave of the Great Depression, also known as the recession of 1937–1938. Due to this period's lack of quantitative forecasts, this paper employs a methodology established by recent studies that converts qualitative statements about the U.S. economy into testable, quantitative data. Specifically, these statements are scored according to their outlook and type then converted into indices. These indices are then compared to the Index of Industrial Production, which embodies the real trend of the national economy during this period. The results of this analysis demonstrate that the public and private sectors accurately assessed and understood national economic fluctuations as they occurred. Furthermore, although the private sector's forecasts were slightly less over-optimistic than in the first wave of the Great Depression, in aggregate, the forecasts were consistently over-optimistic in that they remained positive for the vast majority of the two-year period. Moreover, the forecasting index both had a negative correlation with the Index of Industrial Production and failed to recognize the beginning and end of this recession. The continuity of the business community's over-optimism and inaccuracy from the first to the second wave of the Great Depression indicates that the business community did not learn from the forecasting mistakes made during the first wave of the Great Depression.

PRIMARY PRESENTER

Christian Roatta

STATUS

Student – Undergraduate

AUTHOR

Christian Roatta

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tara Sinclair

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Culture, Time-Orientation, Coping Style, and Their Effects on Procrastination

With the rapid development of new media in the present age, procrastination has become increasingly prevalent, especially among students. With considerable negative consequences on physical and mental health, academic and career achievements and financial and relationship aspects, a sizable body of research have examined various factors that influence the extent to which individuals procrastinate. However, most current research studying procrastination focuses on western, English-speaking countries. Also, though some research identifies time-orientation can be a significant predictor of procrastination, few study connect culture influence with time-orientation. Building on other studies, this project seeks to understand whether individuals' time-orientations and copy styles mediate the influence of culture on procrastination. Theoretically, this study will fill in the gap of the previous study and extend people's understanding of procrastination. Data are being collected from undergraduate students at the George Washington University. Participants will be approximately 75 domestic American students and 75 sojourning students originally from China. Participants will be asked to fill out a survey questionnaire that measures people's considerations for future consequences, coping styles, motives of social media use, and tendency to procrastinate. Collected data will be analyzed using statistical analysis techniques, such as multiple regression. Results from the research will support or reject the following hypotheses:

H1: Chinese students will have greater concern for future consequences than American students.

H2: Concern for future consequence will be negatively associated with the use of social media to escape/relax, and will be positively associated with the use of social media to learn/get help.

H3: The use of social media to escape/relax is positively associated with the tendency to procrastinate, whereas the use of social media to learn/get help is negatively associated with the tendency to procrastinate.

H4: Concern for future consequences and motives for social media use will mediate the effect of culture on the tendency to procrastinate.

The research will deepen people's understanding of the role of culture and social media use in shaping individuals' tendencies to procrastinate, thus helping people, especially college students, to control their procrastination tendencies.

PRIMARY PRESENTER

Ruihang Shen

STATUS

Student – Undergraduate

AUTHOR

Ruihang Shen

RESEARCH MENTOR/ DEPARTMENT CHAIR

Meina Liu

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Expert Opinion and Restaurant Pricing: Quantifying the Value of a Michelin Star

When studying consumer behavior, one common concern is information asymmetry. Information asymmetry exists when one party in a transaction has more information than the other party. This condition becomes especially problematic when pertaining to the quality of a product, such as with experience goods. In these cases, the consumer does not know the true quality of a product until after the transaction has taken place. As a consequence, when information asymmetries increase, consumers are often guided by expert opinions in their consumption decisions.

This paper investigates the relationship between expert ratings and the restaurant market. Specifically, this paper aims to broaden our understanding of the experience goods market by looking at the effects of both having an expert-awarded Michelin star and earning or losing a Michelin star on New York City restaurant prices. The Michelin Guide is one of the world's leading expert restaurant review sources. Therefore, it is important to investigate the influence that the Guide can have on consumer behavior in order to gain a better understanding of asymmetric markets. This study analyses ratings from the 2009–2011 Michelin Guides and pricing data from the 2010–2012 Zagat Guides. By using a hedonic pricing model, the results show that there is a significant effect of having a Michelin star on market price. In other words, restaurants that are distinguished by a Michelin star correspond to a higher willingness to pay from consumers. Therefore, these restaurants can afford to raise their prices above those of their competitors. A second hedonic model is designed to test for the effect of earning or losing a Michelin star. However, more data is needed to demonstrate if earning or losing a Michelin star can have a similar effect.

PRIMARY PRESENTER

Carly Shin

STATUS

Student — Undergraduate

AUTHOR

Carly Shin

RESEARCH MENTOR/ DEPARTMENT CHAIR

Bryan Boulier

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Personality and Physical Activity Choices Among College Students

INTRODUCTION

Regular physical activity (PA) is essential for a healthy lifestyle, yet many college students do not get adequate PA. Existing literature has reported that several environmental, social, cognitive and physiological factors influence engagement in PA among college students. However, one gap in the literature is an understanding of which personality factors predict engagement in specific types of PA among college students. Two personality traits that may be related to physical activity are sensation seeking and extraversion. Sensation seeking is characterized by pursuit of varied, novel, complex and intense experiences, and by the readiness to take physical, social, legal, and financial risks for the sake of such experiences. Sensation seeking is composed of four components: experience seeking, boredom susceptibility, thrill and adventure seeking, and disinhibition. Extraversion is characterized by high sociability, talkativeness, and assertiveness.

OBJECTIVE

The objective of the present study was to test whether personality traits of sensation seeking and extraversion were associated with preferences for specific types of PA.

METHODS

Two hundred and seventy-five college students (23.6% male) completed a questionnaire that included Zuckerman's Sensation Seeking Scale-V (Zuckerman et la., 1978), and Eysenck's Personality Questionnaire (1994). Participants reported the type of PA they engaged in. Thirty-seven different activities were listed. Data analysis focused on the nine activities that were most commonly mentioned (i.e., by at least 7% of the sample).

RESULTS

The most commonly listed PA included: running (27.6%), conditioning (22.2%), strength/ weight training (19.3%), elliptical (17.5%), walking (16%), dancing (12.3%), treadmill (12%), cycling (10.5%) and yoga (8.4%). Results showed that college students who engaged in strength /weight (e.g., squats, deadlift) training scored significantly higher on thrill-adventure seeking and extraversion traits compared to those who did not engage in strength/ weight training. Furthermore, those who engaged in conditioning (e.g. Circuit training, Crossfit) scored significantly lower in boredom susceptibility than those who did not engage in conditioning. Furthermore, those who ran on the treadmill had significantly lower boredom susceptibility than students who did not.

CONCLUSIONS

This study adds to the current literature by confirming that extraversion plays a role in the types of PA that individuals engage in. This study further demonstrates that there may be certain factors of sensation seeking (like boredom susceptibility) that create a pull towards certain types of PA.

PRIMARY PRESENTER

Abigail Shonrock

STATUS

Student – Undergraduate

AUTHORS

Abigail Shonrock

Tonya Dodge

Deepti Joshi

RESEARCH MENTOR/ DEPARTMENT CHAIR

Tonya Dodge

SOCIAL SCIENCES

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

On the Status of Public Goods in Washington DC's Central Business District: Golden Triangle Business Improvement District

Author developed the research idea from attending a city hall meeting in Alexandria, VA in Summer, 2017 where over 30 stakeholders discussed the establishment of a Business Improvement District (BID) in their town. A BID spends most of its budget on maintaining three types of public goods: safety, cleanliness, and aesthetic structure. This research focuses on the work of Golden Triangle Business Improvement District, which is known to be one of the most established and located in Washington DC's Central Business District. While there are extensive scholarly articles on various responsibility of a BID, there is merely few raw data on the status of the public goods that a BID maintains with various initiatives and partnerships with government agencies. Author collected data on the three public goods by walking on over 80 sidewalks for 30 days, compiled the data based on Ghel Institute's 12 Quality Criteria and visualized them into 12 heat maps for story telling purpose. Research findings show that the Golden Triangle BID successfully maintain safety and cleanliness, but does not well on aesthetics. There are inadequate opportunities for people to enjoy the District because seating options and street decorations are lacking in many parts of the District. Overall, compared to safety and cleanliness, aesthetic structure is lacking. In conclusion, research findings suggest that the Golden Triangle BID allocate more of their annual budget to the third element because they are already doing successfully on the first and the second.

PRIMARY PRESENTER

Hae Jin Son

STATUS

Student – Undergraduate

AUTHOR

Hae Jin Son

RESEARCH MENTOR/ DEPARTMENT CHAIR

Elisa Hovander

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Cohabitation as a Moderator of Conflict Engagement and Coparenting in Low-Income, Ethnic Minority Mothers

A positive coparenting relationship is associated with fewer child externalizing problems (Schoppe, Mangelsdorf, & Frosch, 2001). Family systems theory posits that conflict can "spillover" across family subsystems. Indeed, marital conflict has been highly associated with coparenting conflict (Margolin, Gordis, & John, 2001). Because many low-income Black and Latino families face financial barriers to marriage, cohabiting status may be a more appropriate indicator of a committed relationship (Edin & Reed, 2005). While cohabiting parents may have more opportunity for spillover, non-cohabiting parents may have relationships that are more sensitive to conflict spillover, as they face increased risk for family stress and may not experience sufficient positive interactions for relationship satisfaction (Amato & Cheadle, 2008; Gottman & Levenson, 1992). We hypothesized that within a sample of low-income, ethnically diverse mothers, high conflict engagement will be inversely associated with coparenting relationship quality, and cohabiting status will moderate this association.

Participants were 99 ethnic minority (72% Black, 18% Latino), low-income mothers ages 18–59 years (M = 30.95, SD = 8.97), with a young child (M = 5.46, SD = 3.37, range = 4 months to 12 years). The majority of mothers were unmarried (78%) and non-cohabiting (62%). Frequency of conflict engagement was measured using a subscale of the *Conflict Resolution Style Inventory* (CRSI; Kurdek, 1994), with higher scores indicate more frequent conflict engagement. Coparenting relationship quality was measured using the *Coparenting Relationship Scale* (CRS; Feinberg, Brown, & Kan, 2012), with higher scores indicating more positive coparenting relationships.

As hypothesized, hierarchical regression analysis indicated that frequency of conflict engagement was inversely associated with coparenting relationship quality (β = -.306, p = .002). The interaction of conflict engagement and cohabiting was significantly associated with coparenting relationship quality (β = .902, p = .018), such that the association was stronger for non-cohabiting mothers.

Conflict engagement may be an important predictor of coparenting relationship quality for non-cohabiting parents. High engagement in conflict may be especially damaging to the coparenting relationship for non-cohabitating parents, as they have fewer opportunities to counterbalance negative interactions (Carrere & Gottman, 1999). As cohabiting parents can more frequently foster positive, cooperative relationships (McClain & DeMaris, 2013), high conflict in the context of a supportive relationship may be less detrimental to the coparenting relationship.

Limitations include our dependence on mother-report; future research could include father-report or observational data. Additional research could examine whether the balance of positive to negative interactions relates to coparenting relationship quality.

PRIMARY PRESENTER

Samuel Swisher

STATUS

Student – Undergraduate

AUTHORS

Barunie Kim

Samuel Swisher

Katy Pokorny

RESEARCH MENTOR/ DEPARTMENT CHAIR

Christina Gee

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Understanding the City's Role in Climate Action

Cities across the United States are creating sustainability plans in order to improve the quality of life in their cities. An important aspect of almost every plan is Climate Action, that is, how the city will adapt and protect its citizens against our changing climate. The following study examines the sustainability plans of 20 different cities of various climates, political atmospheres, demographics, and populations. For this study, municipal plans were examined on how holistic their approach was to Climate Action, how these cities adapt their plans to their specific climate and political characteristics, and how the cities see their role in sustainability. It was concluded that the most holistic sustainability plans incorporated Climate Action throughout their plans and were able to address each of the six found areas of Climate Action (extreme precipitation, drought, heat wave, rising sea level, and biodiversity). Additionally, the plans that had the best practices were able to adapt their Climate Action plan to their city's specific climate, political atmosphere, and unique needs. From this study, it is reasonable to believe that a city's climate and political situation have an effect on how cities view their role in sustainability and how effectively they are able to address Climate Action. Moving forward, these findings could be used to create more efficient approaches to Climate Action and let municipalities know where their plans are lacking in addressing Climate Action.

PRIMARY PRESENTER

Jacquelyn Veatch

STATUS

Student – Undergraduate

AUTHOR

Jacquelyn Veatch

RESEARCH MENTOR/ DEPARTMENT CHAIR

Melissa Keeley

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Examining the Relationship Between Trauma Exposure, Presence of Meaning, and Mental Health Outcomes in a Sample of Student Veterans

Most, if not all, people desire for their actions to serve a greater purpose in life. Viktor Frankl in *Man's Search for Meaning* (1959) proposed that people with a sense of meaning in their life could survive any hardship. However, since Frankl's seminal work there has been scarce quantitative research on how having a purpose in life affects an individual, in particular, how it may relieve stress. For populations that experience significant stress and trauma, e.g. military veterans, meaning in life may be particularly important. Student veterans face exposure to trauma while in the military, and also when returning to civilian life, including enrolling in college.

In this study, I plan to examine the relationship between trauma exposure, presence of meaning, and mental health within a sample of student veterans. I hypothesize that student veterans with higher trauma exposure will experience more mental health struggles; in other words, trauma exposure and mental health outcomes will be positively correlated. Additionally, I predict that prevalence of meaning will moderate, or buffer, the relationship between trauma exposure and mental health such that the relationship between trauma exposure and mental health will weaken as prevalence of meaning increases.

PRIMARY PRESENTER

John Venezia

STATUS

Student – Undergraduate

AUTHORS

John Venezia

Meagan Ryan

Cynthia Rohrbeck

RESEARCH MENTOR/ DEPARTMENT CHAIR

Cynthia Rohrbeck

SOCIAL SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Super Centers or Supermarkets? Wal-Mart's Effect on Supermarkets in Cities

Wal-Mart Supercenters have generated much controversy since its inception in 1988. With economies of scale, scope and density, Wal-Mart Supercenters rose to the top of the retail food chain with their "everyday-low-prices". This paper departs from previous studies in the geographic scope of my data. I choose my sample not from rural or micropolitan areas within a particular state but the metropolitan areas and cities across United States. This paper found that increase of Wal-Mart Supercenters is associated with a negative sales decrease in supermarket sales holding all else constant. However, though the sales of the incumbent market does shrink, it lowers by an economically insignificant amount. Plausible explanations could be attributed to that metropolitan supermarkets are able to reposition to focus on quality rather than quantity after Wal-Mart's entry.

PRIMARY PRESENTER

Alex Wang

STATUS

Student – Graduate

AUTHOR

Alex Wang

RESEARCH MENTOR/ DEPARTMENT CHAIR

Anthony Yezer

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Framing Sexual Abuse in Hollywood: Episodic and Thematic Framing in the Pre- and Post-Weinstein Eras

This study examines how sexual abuse in Hollywood is framed by legacy news media organizations. It utilizes a content analysis of articles in *The New York Times*, *The Washington Post*, *USA Today*, *People Magazine* and the *Los Angeles Times* that discuss sexual abuse allegations against individuals in the film and television industries. In particular, the study looks for use of thematic and episodic framing of sexual abuse in Hollywood in two time periods: before the October 2017 allegations of harassment and assault against Hollywood producer Harvey Weinstein and after the months following the allegations, up to December 31, 2017. Multiple successful Hollywood industry members had been accused of abuse before the Weinstein allegations. Even more accusations came out after the Weinstein allegations, many of which had been open secrets in Hollywood for years. This research examines whether journalists provided context through thematic framing in their coverage of sexual abuse in Hollywood or whether they presented each case of abuse as its own instance through an episodic frame. This study builds on framing literature by expanding frame categories to include the following: Thematic Institutional Frame; Thematic Cultural/Structural Frame; Full Thematic Frame; Thin Movement Frame, and Pure Episodic Frame. These frames attribute responsibility differently and demonstrate the broader range of thematic and episodic frames used in the coverage of a large scandal. If Hollywood sexual abuse is framed as a cultural problem, responsibility for reform lies with the industry to reprimand powerful individuals who abuse their power. If it is instead framed episodically, blame lies with individual victims and assaulters, leaving the larger culture and industry blameless. The study considers directors, actors and producers in Hollywood who have achieved varying levels of fame and success in the industry. It also examines differences in coverage of accused perpetrators of abuse based on age, race, gender, and role within the industry as well as who journalists cite in their coverage of Hollywood sexual abuse. It looks for mentions of the "Weinstein Effect" and "#MeToo Movement," as well as identifying the topic of each article. The research examines whether any of these elements coincide more frequently with different frames.

PRIMARY PRESENTER

Lande Watson

STATUS

Student – Undergraduate

AUTHOR

Lande Watson

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Entman

SOCIAL SCIENCES

SCHOOL OF MEDIA & PUBLIC AFFAIRS

Asymmetric Campaign Advertising: Partisan Differences in 2014 Congressional Campaign Advertisements

This preliminary study identified partisan difference in television advertisements for Senate candidates in 2014, and paves the path for further study of partisan differences in campaign advertising more broadly. Analyzing data gathered on all of the television advertisements aired for U.S. Senate candidates in 2014, this research finds distinct partisan styles emanating from both of the major political parties. In particular, the data suggests that candidates for the Republican Party used more cohesive messaging during the 2014 election cycle, while candidates for the Democratic Party advertised on a wider array of issues. These findings align with previous research on partisan asymmetry in the United States, and have important implications for future campaigns. Understanding how campaigns advertise to voters is one of the first steps to addressing growing polarization in Congress.

PRIMARY PRESENTER

Daniel Wetter

STATUS

Student – Undergraduate

AUTHOR

Daniel Wetter

RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert Entman

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Impact of Non-Prescription Stimulant User Prototypes and Academic Outcomes on Decisions to Use

Academic enhancement is the primary motive for nonmedical prescription stimulant (NPS) use (e.g., taking Adderall without a prescription), which is a growing problem on college campuses. Few studies have explored causal mechanisms that predict NPS use decisions. The current study applied the Prototype/Willingness Model (PWM) to test how prototypes (i.e., images of the typical person who engages in a behavior) and outcomes attached to prototypes (e.g., academic success or failure) impact NPS risk cognitions including decisions to use. The PWM is unique because it acknowledges that risk behavior can be planned or a reaction to the social situation (e.g., a student decides to take a pill when a friend offers it for studying). Moderated mediation was also investigated to examine whether exposure to a story about a NPS user who reports positive academic outcomes affect willingness to use via the belief that stimulants are effective.

172 undergraduates participated in an experimental study using a 2x2 between-subjects design. Participants read about a student who: 1) either used or abstained from using NPS for studying (prototype manipulation), and then 2) performed well or poorly on exams as a result of their behavior (outcome manipulation). Afterwards, student perceptions, NPS beliefs, and decisions (i.e., willingness) to use NPS for academic reasons were measured.

ANCOVAs revealed significant main effects of prototype and outcome condition on student perceptions such that abstainers (vs. users) and those who performed well (vs. poorly) were rated more favorably. Another significant main effect of prototype was observed on the belief that stimulants are an effective study aid with those who read about a user (vs. abstainer) rating NPS as more effective. A significant prototype x outcome interaction on NPS belief was also found indicating that participants who read about a well-performing user reported the highest levels of stimulants being effective. In addition, there was a significant prototype X outcome interaction on willingness indicating that students who read about a user (vs. abstainer) who performed well (vs. poorly) reported greater willingness to use. Moderated mediation was supported such that reading about an NPS user led to increased willingness to use NPS via greater belief that prescription stimulants are an effective study aid. However, this relationship only existed for those who read about a user *who performed well*.

Findings suggest that effectiveness beliefs are crucial to evaluations of willingness to use. Merely learning about a user's success with NPS can impact use decisions.

PRIMARY PRESENTER

Laura C. Wolter

STATUS

Student – Undergraduate

AUTHORS

Laura C. Wolter

Brianne K. Molloy

Michelle L. Stock

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michelle L. Stock

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Sun Protection Cognitions and Behaviors Among White and Hispanic Young Adults

The current study examined racial and gender differences in tanning and sun protection attitudes and behavior among Non-Hispanic White and Hispanic college students. Participants (N=264, 64% Non-Hispanic White; 36% Hispanic) reported their willingness to intentionally tan in the sun, past intentional tanning in the sun, injunctive and descriptive norms about skin protection and tanning, perceived vulnerability to and worry about skin damage, attitudes about oneself being tan, and gender stereotypes of skin protection. ANCOVA analyses revealed females (vs. males) (p<.01) and Whites (vs. Hispanics) (p<.001) held more positive attitudes about themselves being tan. Females (p<.001) and Whites were also more likely to believe others in their demographic groups approved more of skin protective behaviors (p=.055), but both groups also paradoxically perceived tanning to be more prevalent among their same gender/race peers (p<.01). Thus, these populations may receive conflicting messages about the benefits of both being tan and protecting one's skin. Likewise, females and Whites reported greater willingness to intentionally tan (p=.001, p=.014) and more past intentional tanning behavior (p<.001, p=.015). Conversely, there were no differences among participants' willingness to expose themselves to the sun *without* the goal of tanning. This implies that while female and White young adults may be at greater risk for intentional tanning, females and White young adults may not differ from males and Hispanic young adults in their susceptibility to sun exposure without tanning intentions. Additionally, females (p=.035) and Whites (p=.021) felt more vulnerable to skin damage. In general, men (vs. women) (p<.001) more strongly endorsed the belief that sun protection is more important for women than it is for men. Likewise, men (vs. women) were more likely to agree that skin protection is not "manly" (p=.025), however, this effect was only present among White, not Hispanic, males. White women specifically were more likely to express intentions to tan (p<.05) and to believe that those around them would respond positively to them being tan (p<.05). In sum, both race and gender influenced cognitions and behaviors related to skin protection and tanning. Results indicate that future interventions should consider how sun protection and tanning cognitions differ for males versus females and among different racial groups.

PRIMARY PRESENTER

Paula Zanotti

STATUS

Student – Undergraduate

AUTHORS

Samantha Dewees

Paula Zanotti

Charlotte Hagerman

Michelle Stock

RESEARCH MENTOR/ DEPARTMENT CHAIR

Michelle Stock