

Response of Great Lakes Coastal Wetland Plant Communities to Climate Change

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Wetland vegetation along the Great Lakes shoreline has been affected considerably by climate change, water levels, and human activity over time. In order to understand the dynamics of Great Lakes coastal wetlands better, we must discover a relationship between plant communities and climate. This project seeks to establish a relationship using field data collected at Negwegon State Park near Alpena, Michigan. Plants were classified into communities using non-metric multidimensional scaling (NMS) and cluster analysis. Among various metrics used to describe the vegetation data, frequency and importance value of species resulted in the best grouping of the plant communities. Environmental variables tied to climate, such as hydrologic variables, soil characteristics, geological setting, and wetland ages were correlated with plant community composition. Hydrologic variables were the most significant environmental drivers, as identified by correlation with NMS results, and likely will be the most influential in determining trajectories of plant community change. Our discovery supplements current knowledge of plant community response to climate change, and therefore, may assist managers who are making critical decisions for wetland habitat, especially in the Great Lakes region.

eBay Behavioral Game Theory: A Support Vector Model

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Over the past 15 years, the process of purchasing an item has changed dramatically. Through the creation of online bidding and purchasing on eBay, it is now possible to buy an item with almost no knowledge of the seller or item quantity. This presents the possibility that an item may arrive to the bidder in an unacceptable condition, the item is a counterfeit, or the seller did not even ship the item (Saigal). Auction sites do provide feedback systems to give the buyer an idea of whether or not an online seller is reliable; however, these systems are very flawed. Buyers who are unsatisfied with the item quality often do not give negative feedback for fear that they may receive negative buyer feedback in return (LaPlante). Due to this inflation in seller ratings, the feedback system cannot be used directly to determine seller reliability.

The goal of this project is to formulate equations that will model whether or not a buyer should purchase an item from a seller of a certain rating, and how much the buyer should be willing to pay. Traditional game theory and probability theory methods, including utility functions and the Nash Equilibrium, are applied to model eBay transactions. The derived Nash Equilibrium equation depends on a variable known as α , the probability that the seller is trustworthy. Our goal during the fall and winter semester was to use a multidimensional analysis tool, called a support vector machine, in order to find trend lines that will help us determine a more accurate α . By categorizing and labeling data that has been gathered from eBay, the support vector machine will give formulas that will determine how to find α for an unknown seller. This will be useful not just for the buyer, but the results will also potentially create a form of third party insurance that could be used to protect eBay users from fraudulent transactions.

Ex-Offender Transition Study

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The Joyce Foundation began the Transitional Jobs Reentry Demonstration to assist former prisoners in finding employment. Statistics show that two-thirds of those released from prison are rearrested, half being within the first three years of release, usually not because they have committed new crimes but rather because they have violated the rules of parole supervision, namely not being able to find a job and maintain a residence (Dan Bloom, MDRC). The goal of this research is to see how former prisoners benefit from the prisoner reentry programs. Ultimately, the research hopes to discover if the program is successful in the readjustment of former prisoners back into a functional lifestyle in society, with steady employment, a place of residence and emotional support. Professor Alford Young, Jr. has interviewed thirty-three participants in the program when they first entered the program and then again a year later, asking them about their employment, self-identity, and how they feel they are viewed in society. These interviews are currently being read over and coded as to what category they fall under, focusing on either the former prisoners' concept of time or identity. They then are analyzed further into subcategories to try to find commonalities and differences among the participants. Once the interviews have been completely analyzed, there will be further evidence on the benefits of the program. This research is still ongoing, and there are no definite conclusions. As of now, the research is looking to code, analyze and develop interpretive themes for the data. The research hopes to draw conclusions on how the reentry programs are affecting their lives after reentering society. However, since it is still in its beginning stages, there is no way to have a projected outcome.

Identification of *Bacillus anthracis* Genes Required for Growth in Blood

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Bacillus anthracis is a pathogen that can remain dormant for a prolonged period of time. Once a host is infected, spores first germinate and begin to replicate within phagocytes, then proceed through the lymphatic system, and finally make their way into the bloodstream. Antibiotics and vaccines previously developed are not effective treatments, resulting in a demand for a more in-depth understanding of how exactly anthrax infects its host, and how it functions once it is inside the host. A greater understanding of the pathogen's virulence can result in new potential drug and vaccine targets. Analysis of gene expression profiles of *B. anthracis* grown in blood yielded a list of potential genes to target in future studies. It is hypothesized that some of these genes are important to the survival of anthrax in the host's bloodstream. The objective of this project is to create mutant strains of *B. anthracis* through homologous recombination, which will lack specific genes chosen from the microarray results. The mutant *B. anthracis* strains will be examined for the ability to grow in blood, and compared to that of wild type *B. anthracis*. Mutant strains that show decreased growth in blood will be further tested for virulence in a mouse model of inhalational anthrax. Mutant strains that show decreased growth in blood and decreased virulence in a mouse model would show that the particular gene knocked out could be used as a potential new target for treatments.

Consequences of Perfectionism Scale: Gender Differences and Associations with Affectivity and Life Satisfaction

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The Consequences of Perfectionism Scale (COPS) is a newly developed multidimensional scale involving two factors that assess for perceptions of perfectionism as adaptive (e.g., “being perfectionistic drives me to be motivated”) and maladaptive (e.g., “being perfectionistic hinders me from pursuing my goals”). In the present study, we examined the gender differences of COPS and analyzed the associations between scores on the COPS with scores on measures of positive and negative affectivity and life satisfaction. We also tested the COPS against the Ruminative Response Scale (RRS) to see if it adds to the prediction of life satisfaction and positive and negative affectivity. Results indicated no significant differences in mean levels on the COPS between men and women, and also suggested that the COPS is a better predictor of positive affectivity and satisfaction with life in males compared to the RRS. Overall, findings from the present study provide further evidence of the validity and usefulness of the COPS.

Being a Good Mom, Cricket Style: Do Insects Have Hormone-Mediated Maternal Effects?

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Numerous studies indicate that animals from diverse groups can influence the survival and success of their offspring via non-genetic, maternal effects in which the environment experienced by the mother is translated into phenotypic variation in the offspring. It is also known that in vertebrates, such as birds, these effects are frequently mediated by the hormone testosterone. While maternal effects are common in insects, they have no such steroid sex hormones. Juvenile hormone (JH), a ubiquitous and important invertebrate hormone that produces several of the same effects as testosterone, is a promising candidate for mediating insect maternal effects. This study seeks to discern the presence of maternal effects – in particular, hormone-mediated maternal effects mediated through JH – in insects, using field crickets as a model system. Virgin female field crickets, *Acheta domesticus*, were randomly assigned to one of two treatments: early mate, in which a female mated for the first time five days post-eclosion, or late mate, in which a female mated for the first time twenty-five days post-eclosion. In both treatments, the females’ eggs were collected three days after mating, and the egg size, number of eggs laid, and the amount of JH in each egg were determined. We hypothesized that females may adjust their reproductive effort depending on female age and male mate quality. For instance, if a female mates for the first time late in her life, she might allocate more of her resources into reproduction, thus resulting in bigger eggs, more eggs, and/or more JH per egg. Alternatively, if a female mated with a preferred male, she might similarly allocate more resources to his offspring than would a female mated to a non-preferred male. If we find evidence for hormone-mediated maternal effects (i.e. the crickets allocate additional JH to their offspring under some circumstances), a follow-up experiment will determine how high JH titers affect the crickets once they are born (by measuring size, competitive ability, and survival, for instance).

The Effects of Androgen Metabolites on Prostate Cancer Growth

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Prostate cancer is the most commonly diagnosed cancer among men in the United States. Prostate cancer growth is primarily driven by androgens, and anti-androgens are frequently employed therapeutically. However, resistance to therapy is a common occurrence that is not well understood. Androgens activate the androgen receptor, which induces growth. Testosterone is the primary androgen in men and women, but it is not very potent. It is converted in the body by the enzyme 5α -reductase to the steroid 5α -dihydrotestosterone (DHT), which is the active androgen in the body. DHT is further reduced to 5α -androstane- 3β , 17β -diol (3β Adiol) by the enzyme 3β -hydroxysteroid dehydrogenase (3β -HSD). 3β Adiol is a ligand of both estrogen receptor α (ER α) and β (ER β). Despite the fact that 3β Adiol is an androgen metabolite, it does not bind the wild type androgen receptor (AR). However, it has been demonstrated that the mutated AR is more promiscuous and is activated by a variety of ligands such as androgens, progestins, estrogens, and anti-androgens. My project investigates the effects of androgens and their metabolites on growth in prostate cancer cells. We hypothesize that 3β Adiol is a ligand of the mutated AR. Further, the generation of androgen metabolites that differentially modulate ER and AR may represent a potential mechanism of resistance to therapy. To examine how androgen metabolites modulate ER and AR we are using growth assays of prostate cancer cells in culture. These experiments may give insight to possible mechanisms of androgen metabolites to resistance in prostate cancer.

Assessing the Effectiveness of Innovations in Undergraduate Anatomy Education

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The promotion of undergraduate anatomy education is a rapidly growing trend on college and university campuses nationwide. With this advancement comes the responsibility to monitor the quality of such valuable, relevant education. In its eighth year and sponsored by Dr. Ameed Raof, the project assesses the effectiveness of undergraduate anatomy education at the University of Michigan by conducting survey research on students enrolled in the course Anatomy 403. The project seeks to see how well undergraduate students from many different backgrounds perform in and feel about an upper level science course in the field of anatomy. Surveys are distributed to undergraduate students enrolled in Anatomy 403 two times during each semester, once after the midterm examination and once after the final. These surveys are comprised of a wide range of detailed questions of both the qualitative and quantitative variety. After collecting the surveys and ensuring confidentiality, Microsoft Excel is utilized to compile the data and analyze it accordingly, including comparing it to previous terms in which Anatomy 403 was taught. Ideally the results will provide a good indication of the current quality of undergraduate anatomy education at the University of Michigan; thus far, the figures suggest an overall student sentiment of satisfaction with the Anatomy 403 course, particularly its plastination laboratory component. On a larger scale, the hope is to use the findings to increase students' interest in enrolling in courses on the topic of anatomy, a lifelong learning process that is fully applicable to everyday life.

Bridge to Lung Transplantation Using Atrial Septostomy and Veno-Venous Extracorporeal Membrane Oxygenation

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Pulmonary hypertension often leads patients to develop right ventricular failure and death. Despite conservative measures, patients require lung transplantation. However, one third of patients die while on the waiting list. Atrial septostomy (ASD) has been performed clinically to offload the right ventricle until transplantation; however, shunting of blood from the right to left atrium causes hypoxemia. A novel approach to improve right ventricular failure and maintain normal oxygenation may be the combined use of ASD and extracorporeal membrane oxygenation (ECMO). This study was designed to investigate if a combined ASD and ECMO modality can be an effective bridge to lung transplantation. Using a sheep animal model, a thoracotomy was performed under adequate anesthesia and analgesia to create an atrial septostomy. After a day of recovery, the sheep were placed on veno-venous (VV) ECMO. This involves drainage of blood from the inferior vena cava (IVC), gas exchange through a membrane oxygenator, and reinfusion into the right atrium. After initiation of ECMO, a clinical model of pulmonary hypertension was simulated by banding of the pulmonary artery. Sheep hemodynamics, ECMO flow, and blood chemistries were monitored. Results to date have shown that this combined modality maintains normal cardiac output with acute pulmonary hypertension, however there is slight hypoxemia. It is thought this is related to insufficient ECMO flow due to anatomic factors in sheep that affects double lumen cannulae position. This results in inadequate ECMO flow due to reduced blood drainage from the IVC. Despite drainage complications, these findings suggest that ASD with VV ECMO could be an effective bridge to lung transplantation.

Measurement and Analysis of Advanced Nuclear Fuels for Safeguard Applications

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As nuclear power becomes a more viable resource for clean energy, a need arises for its safe use to our best ability. One problem is related to the spent fuel of reactors; specifically, how it can be disposed of in the most efficient way. One alternative to the disposal of the nuclear materials is to recycle them in mixed-oxide fuels that can then be put back into the reactors, preventing excess of waste. The need for safeguards techniques to accurately characterize such advanced nuclear fuels is therefore in great demand.

This research focuses on detecting and characterizing mixed-oxide fuels using Monte Carlo simulations and measurements performed at the Idaho National Laboratory in June 2009. The mixed-oxide fuels were measured by running a series of tests on two well-defined fuel pins. The fuel pins will be characterized by looking at time-correlated and pulse-height distributions of the measured gamma rays and neutrons. The examination of the results involves finding the pulse-shape of each particle and its time signature for the cross-correlation functions. These developed pulse-height distributions and cross-correlation functions will be compared to simulation results. Once the analysis is complete, conclusions will be drawn as to how accurate the proposed method is to efficiently identify and characterize these mixed-oxide fuels.