### Natural Science/Engineering

**Pie Pichetsurnthorn**

**Growth and Differentiation of Neuronal Cells in Injectable Collagen Hydrogel for Neural Regeneration**

Faculty Sponsor: Li Yao
College of Engineering

Injury to the central nervous system including brain and spinal cord causes neuron death and demyelination and these tissues have limited intrinsic regenerative capacity. Transplantation of neuronal cells to the lesion of the injured neural tissue may generate therapeutic effect. However few cells may survive in the hostile environment. Injectable hydrogel serving as cell carrier may overcome this challenge by providing the cells a permissive environment to generate function locally. In this study, we tested the ability of collagen hydrogel as a carrier for neuronal cell transfection and differentiation. PC12 cells were seeded in the collagen hydrogel and differentiated with nerve growth factor (NGF) stimulation. To study PC12 cell transfection and differentiation in the hydrogel, plasmids encoding NGF-ires-EGFP were complexed with Fugene transfection reagent. The complexed pNGF-ires-EGFP was incorporated into the hydrogel seeded with PC12 cells. We observed that PC12 cells were transfected in the hydrogel and expressed EGFP protein. PC12 cells differentiated and generated neurites. To investigate axonal myelination, we isolated oligodendrocyte progenitor cells and dorsal root ganglion (DRG) from neonatal rats. We characterized the phenotype of OPCs and induced OPCs differentiation into oligodendrocyte in cell culture. Myelination of axons in the co-culture of OPCs and DRG was observed. In the future studies, we will co-culture OPCs and DRG in the hydrogel to study the myelination of axons in this 3-dimensional cell culture system.

### Humanities/Social Science

**Robert Freeman**

**Will Depreciation of The Dollar Decrease the U.S. Trade Deficit?**

Faculty Sponsor: Jen-Chi Cheng
Barton School of Business

Using data on exchange rates, imports and exports, income, and relative price between the US and its major trade partners, I applied regression analysis to determine whether there is a connection between a weakening of the US dollar and an increase in US exports. I studied the price elasticity and income elasticity for both the short run and long run. The key hypothesis is that the gains in US exports to its top trading partners due to a weaker dollar will be offset by decreased income from exporting to the US. The results indicate that in the long run 3 of the 5 US trade partners examined do not meet the Marshall-Lerner condition, supporting the hypothesis, which will diminish the hope of improving the U.S. trade deficit.
This performance will feature three movements of J.S. Bach’s Violin Partita No 1 in B minor, that the performer has adapted for marimba, an instrument, which has its origins in traditional African and Latin American music. The selected movements will include: the Sarabande, Double, and Tempo di Bourrè (Gavotte) respectively.

Each of Bach’s Sonatas and Partitas for Violin are lengthy compositions from the Baroque Period, made up of short dance movements alternating with filler material. Bach bases the rhythm of each dance movement on its original Baroque dance steps. The Sarabande is a stately dance of Spanish origin. The selected Double movement is a filler movement, not necessarily composed to fit a particular baroque dance, but certainly with its own unique musical ideas. The movement titled “Tempo di Bourrè” is a Gavotte, which is based on a lively French folk dance with a very strong duple feel. The listener will notice a definitive change in mood and tempo between the Sarabande and the Gavotte movement.

Of critical importance to performing this work on any medium is attaining knowledge of how each of the different dance movements is to be performed. By researching the characteristics of the individual dance genres the performer gains insight into Bach’s original intent in composing the work. When learning the piece on a non-traditional instrument such as the modern marimba, the performer should listen to numerous violinists’ interpretations as a resource to help adapt Bach’s music to the new instrument. The culmination is to use the research and specialized marimba techniques combined with the instrument’s unique musical capabilities to create a new and convincing interpretation.

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**Second Place Winners-Oral**

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<th>Natural Science/Engineering</th>
<th>Emily Rose</th>
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**Follicle-Stimulating Hormone Receptor Binding by Glycoforms**

Faculty Sponsor: George Bousfield
Fairmount College of Liberal Arts and Sciences

Follicle-stimulating hormone (FSH) functions to stimulate ovarian follicle development in the ovaries in females, which is essential for oocyte maturation. In males, FSH regulates Sertoli cell function in the testis. Human FSH exists as a heterogenous mixture of two glycoforms, differing in glycosylation of the beta-subunit. One major glycoform, FSH-24 is glycosylated at all 4 N-glycosylation sites and is indicated in Western
blotting by the presence of a 24 kDa band. FSH-21 is characterized by a partially-glycosylated beta-subunit, and seen in Western blotting by the presence of a 21 kDa band. Glycosylation patterns of hFSH can affect receptor binding and activation.

As FSH receptors are known to exist as dimers or as oligomers, FSH binding to one ligand-binding site may influence binding to the other sites in the receptor complex. Our hypothesis was that negative cooperativity would limit FSH-24 to only one ligand-binding site per dimer, whereas FSH-21 would not exhibit negative cooperativity and could bind both sites. We tested this hypothesis by measuring dissociation in the presence and absence of cold FSH glycoforms.

Negative cooperativity was measured by loading FSH membrane receptors with 125 I-hFSH tracer for 24 hours at 25°C, followed by measuring dissociation over the course of 3 hours, at 30-minute time intervals in the absence of cold hormone, or in the presence of either pFSH (FSH-24 only) or eFSH (90% FSH-21). The amount of tracer bound to FSH receptor membranes was measured in a gamma counter and plotted against time.

Dissociation of 125I-hFSH tracer at receptors occurred only in the presence of 1000-fold excess unlabeled FSH glycoform competitors. The dissociation from FSH receptors by both glycoform tracers was consistent with negative cooperativity by both pFSH and eFSH, causing us to reject our current working hypothesis.

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<th>Humanities/Social Science (tie)</th>
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<td><strong>How University Students Continue to Live in a Bilingual Society in Puerto Rico</strong></td>
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<td>Faculty Sponsor: Philip Gaunt</td>
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<td>Fairmount College of Liberal Arts and Sciences</td>
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One of the most critical questions for Puerto Ricans today is whether or not to become the 51st state of the United States of America. In a recent interview with Pedro Pierluisi, Puerto Rican commissioner to the U.S. Congress, he discusses the advantages and disadvantages of becoming a sovereign state. One of the biggest disadvantages is that Puerto Rico would have to make English their primary language while currently Puerto Rico functions as a bilingual society. Why is the question of language so important? What role does language play in Puerto Rican culture? How does one culture survive with two national languages? Is one language used more than the other and why? I want to know in what social settings Puerto Ricans use Spanish and in what other social settings they use English. To do this I will compare how Puerto Rican college students use literature and social media inside and outside of their university.
Many high schools today employ a conventional model of schooling for students in
grades 9-12. This model includes traditional, lecture-style classes that follow a
typical schedule of two semesters (four, nine-week terms), midterms, and finals.
Although many students are able to conform to this model, for those who do not,
research shows that alternative education can meet their needs. The purpose of this
study was to determine the structure and effects of an alternative high school in a
small, but growing, Midwestern school district. After a review of the literature,
researchers completed a case study of this high school in order to review its history,
necessity, student population, structure, and effects. This research encompassed both
qualitative data (student surveys and principal/superintendent interviews) and
quantitative data as it sought to determine why these students were in alternative
schools as well as their outcomes. The results of this research may help pinpoint the
continued need for these types of environments in districts and how they can be used
effectively to serve nontraditional students as they find success. Keywords:
dropouts, alternative education, nontraditional students, school structure

Biodegradable metals are a novel class of biomaterials which have promising
interventions in the current biomedical world. Medical implants such as stents, bone
screws and bone plates could be made by biodegradable metals. These implants
would serve their purpose within the patient’s body and disintegrate harmlessly,
eliminating a need for removal surgeries. Magnesium is a prime contender as a
biodegradable metal due to its biocompatibility and biodegradability. Surface
modification techniques are needed to enable its suitability for specific applications.
For example, localized deliveries of drugs are needed from cardiovascular stents to
treat restenosis while localized deliveries of antibiotics are needed from bone plates
to treat post-operative infections. These surface coating techniques should not
significantly change the underlying corrosion behavior of Magnesium while
providing localized drug delivery. Organic coating such as self-assembled
monolayers is a technique which could be used for localized delivery of drugs and
antibiotics from the surface of magnesium. This research aims to evaluate the bio
The corrosion behavior of self-assembled monolayer coated magnesium alloy was evaluated using polarized and unpolarized methods in physiological conditions. These organic coated magnesium metals were subjected to electro chemical corrosion testing, mass loss analysis and hydrogen evolution testing. Comparison of the results obtained between the Organic coated magnesium and the control showed no statistical significant chances in the corrosion behavior. In summary, organic coated magnesium was studied for its bio corrosion properties and this study concludes that these organic coatings do not change the corrosion behavior of the underlying magnesium and thus could be used for modification of magnesium alloy for potential cardiovascular and orthopedic applications.

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<th>Humanities/Social Science</th>
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<td><strong>Maternal Perceptions of Skin-To-Skin Contact and Breastfeeding Practices</strong>&lt;br&gt;<strong>Before and After Healthcare Provider Education and Implementation Initiative</strong>&lt;br&gt;Faculty Sponsor: Barbara Morrison&lt;br&gt;College of Health Professions</td>
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**Background**
Skin-to-skin care (SSC) starting immediately after birth is a new practice being implemented to improve mother-newborn care. SSC correlates with greater initiation, exclusivity, and duration of breastfeeding. However, longstanding hospital practices of separating mother and newborn for infant care are barriers to adopting SSC. Studies indicate healthcare providers’ (HCPs) perceptions, attitudes and support influence SSC implementation and rates of breastfeeding initiation, exclusivity, and duration.

**Purpose**
To compare
1) Maternal perceptions and practice of Birth SSC and breastfeeding, and
2) Maternal reports of SSC support and breastfeeding initiation, exclusivity, and duration before and after HCP SSC and breastfeeding education program.

**Process**
Secondary analysis of surveys eliciting maternal perceptions of HCPs’ attitudes, support and practice of Birth SSC and breastfeeding before and after a 4 hour SSC and breastfeeding education session and official implementation of Birth SSC.

**Sample**
A convenience sample of breastfeeding mothers who birthed normally at a community hospital in northeast Ohio between June 2008 and June 2009.

**Results**
Significantly more mothers initiated SSC immediately after birth and did any SSC before leaving the birthing unit after HCP education and SSC implementation. Breastfeeding rates and maternal perceptions of HCP support and SSC practice were not significant between groups. Comparison of maternal perceptions of SSC and
breastfeeding between groups will be reported.

Conclusions
Even though evaluation was done while HCPs were completing required education, significantly more mothers did some SSC after implementation date. Further evaluation is needed after HCP education is completed and Birth SSC is fully implemented.

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<th>Second Place Winners-Poster</th>
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<td>Natural Science and Engineering</td>
<td>J. Tanner Lampe</td>
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**Management of Invasive Species: Sericea Lespedeza Insights from an Optimization Model**
Faculty Sponsor: Esra Buyuktahtakin
College of Engineering

Native grasslands in the Great Plains are threatened by the spread of Sericea (Lespedeza cuneata). Sericea is a non-native legume originating from Asia. Sericea infestations negatively impact the forage value and hay production from grasslands resulting in substantial economic losses to landowners. Furthermore, this invasion threatens the integrity of native and restored prairies as it chokes out native flora and alters the habitat. Although herbicides are available, effective control can be expensive because of the scale of the problem and the necessity of iterated application to combat the plant’s long-lived, extensive seedbank. Herein proposed is an optimization model to find economically efficient strategies to control the invasion of Sericea. Using empirical data, the model accounts for population growth rates, carrying capacity, seed dispersal, treatment costs, and economic loss due to invasion. The model is then utilized to minimize the discounted sum of damages, prevention/restoration, and control costs over time subject to two constraints: the spread of invasive species over space and time and the cost of resources to control and prevent Sericea. Results from model reflecting the outcome of different management scenarios are presented to give insight to economically efficient strategies for controlling Sericea in the Great Plains.

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<th>Humanities and Social Science</th>
<th>Jeffrey Millspaugh and Victoria Burns</th>
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**Investigating Students’ Readiness for Interprofessional Education**
Faculty Sponsors: Lyn Goldberg and Douglas Parham
College of Health Professions

Interprofessional Education (IPE) occurs when students from two or more professions work together to learn with, from, and about each other’s work. The World Health Organization, the Institute of Medicine and academic accrediting
bodies advocate IPE as essential to equip students in healthcare professions for effective Interprofessional Practice. To optimize students’ participation in IPE, it is important to document their readiness for interprofessional learning. Purpose: To analyze the perceived readiness of students according to program (Communication Sciences & Disorders [CSD], Dental Hygiene [DH], Nursing, Physical Therapy [PT], Physician Assistant [PA], Public Health Sciences [PHS]) and level of study (graduate /undergraduate). Method: Students (N = 260) completed the 19-item Readiness for Interprofessional Learning Scale (RIPLS) using 1 (Strongly Disagree) to 5 (Strongly Agree) ratings. The 19 items were categorized into: (1) Teamwork & Collaboration (1-9), (2) Negative Professional Identity (10-12), (3) Positive Professional Identity (13-16), and (4) Roles & Responsibilities (17-19). Results: Two-way ANOVAs documented Main Effects for Program and Level of Study. Post-hoc testing showed significant differences (p = 0.05) in Teamwork & Collaboration: CSD students felt significantly more ready than Nursing, DH, and PA students; Positive Professional Identity: CSD students rated themselves significantly higher than Nursing, DH and PA students; PT students also rated themselves higher than DH and PA students; Roles & Responsibilities: PHS students felt less ready than students in all other programs. Overall, undergraduate students felt more ready for IPE than graduate students. Implications: Faculty need to address such differences in readiness as they facilitate interprofessional learning.