
BARRY UNIVERSITY
4TH ANNUAL
S.T.E.M
RESEARCH SYMPOSIUM
APRIL 4, 2012

S.T.E.M.
SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS

Sponsored by: The Departments of Biology, Information Technology, Mathematics & Computer Science, Physical Sciences, and the Sigma Xi Science Research Society.

Cover Design by: Nicole Beltran

4th Annual S.T.E.M. Research Symposium

This research symposium aimed at engaging the Barry community in learning about and share in the excitement of ongoing discoveries and research within the S.T.E.M. disciplines (Science, Technology, Engineering, and Math). Undergraduate students will present posters related to their past and current research in biology, chemistry, computer science, information technology, mathematics, psychology, and physics.

DAY

Wednesday, April 4, 2012

TIME

10:00 AM - 1:00 PM

PLACE

Andreas 111 and 112

Barry University, Miami Shores, FL

Organized by Members of Barry University's STEM Committee:

Chakib Chraibi PhD, Khaled Deeb PhD, Christoph Hengartner PhD, Peter Lin PhD, and Zuzana Zajickova PhD.

We gratefully acknowledge these sponsors from Barry University:

Department of Biology, Department of Math and Computer Sciences, Department of Information Technology, Department of Physical Sciences, and Sigma Xi Research Society.

Special thanks to:

Dr. Flona Redway, Director of MARC/RISE program, Ms. Michelle Aznarez, and Ms. Audra Bartram for assisting with the Symposium.

BARRY UNIVERSITY - COLLEGE OF ARTS & SCIENCES

Department of Biology

1. Successful year-round fertilization and development of *Fundulus heteroclitus* in the laboratory.

Jodi-Ann Browning-Bent, Ricardo DeMoya, Teresa Petrino, and Y.-W. Peter Lin (Department of Biology, Barry University, Miami Shores FL)

The long term objective of this project is to monitor the reproductive cycle of the fish (*Fundulus heteroclitus*) that are currently being housed in our new aquarium facility. In a previous study, we demonstrated that the fish can spawn successfully in a laboratory environment. This was done by feeding the fish an adequate amount of fish flake food (Tetramin® Fish Flake) and brine shrimp (live and freeze dried) to provide enough caloric energy for gamete formation. At this time, we are further investigating how many eggs are produced per female in each tank, as well as, the successful fertilization of eggs. Fish are housed in 10 gallon tanks, and maintained at stable conditions (water temperature at 26 ± 2°C; salinity 28-30ppt; 14hr light and 10hr dark photoperiod; fed on average 3-4 times each day). Experiments are being carried out to demonstrate: 1) that fish are able to transition from a state of regressed ovaries from the wild and can remain reproductively active throughout the year in the laboratory; 2) successful fertilization of eggs using in vitro fertilization; and 3) successful development of embryos to adults. With the current set up, we were able to successfully collect artificially and naturally fertilized eggs, both developing into reproductively active adults. The data collected will provide information on optimal laboratory conditions for *Fundulus heteroclitus* spawning and development success. In addition, this study will serve as a protocol for establishing a standard husbandry procedure for our future experiments.

Supported by NIH MBRS RISE R25 GM059244 and DOE: No. DE-FG02-06CH11438, Barry University.

2. Investigating marten (*M. americana* and *M. caurina*) population distribution via DNA analysis.

Jodi-Ann Browning-Bent[1], Wynne Mos[2], and Jonathan Pauli[2] ([1]Department of Biology, Barry University, Miami Shores, FL; [2]Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, WI)

Documenting the past and present distribution of populations is of fundamental importance to understanding a species' ecology and evolutionary history. Although the geographical distribution of martens (*Martes americana* and *M. caurina*) in North America is largely known, there remain pockets of unverified marten populations in Wisconsin and southeast Alaska. To determine which species of marten occupies these locations, we used the nuclear gene, aldolase C (*ald C*), a species-specific marker, and marten tissue samples from northern Wisconsin, southeast Alaska, as well as reference samples from known marten populations in North America. DNA was extracted from tissue and ancient bone samples using the tissue and bone extraction protocol. Amplifications were carried out in 10µl volumes via standard reaction profiles. The *ald C* gene for contemporary samples was amplified via polymerase chain reaction and sequenced following successful amplification. Our *ald C* sequences from reference samples revealed that this gene is a reliable species-specific marker. Sequence results from our contemporary samples indicated that *M. americana* inhabits Prince of Wales Island, Alaska and northern Wisconsin, however, reliable sequence data for our ancient marten samples was unsuccessful due to non-specific amplifications. Our findings provide the identification of marten species currently reproducing within this region and will be important information for wildlife managers working on marten conservation in Wisconsin.

Supported by the National Science Foundation (DBI-1063 University of Wisconsin-Madison Graduate School.

3. Determining the role of Pif1p in meiosis.

Christian Bureu, Elizabeth LeBlanc, and Leticia Vega (Department of Biology, Barry University, Miami Shores, FL)

Telomeres are the physical ends of eukaryotic chromosomes and consist of a noncoding repeated sequence. Telomere length may serve as a biological marker for cellular aging. Once telomeres are critically shortened, cells stop dividing, a stage known as replicative senescence. Telomere addition occurs due to the function of the enzyme, telomerase. Human somatic cells do not typically express telomerase, thus, telomeres shorten with each division. In contrast, the budding yeast, *Saccharomyces cerevisiae*, does not undergo cellular senescence because the telomerase enzyme is expressed in every cell cycle. Pif1p is an evolutionarily conserved helicase that serves as a negative regulator of telomerase. Pif1p also helps to maintain mitochondrial DNA. Loss of Pif1p in mitotic cells results in inappropriate addition of telomeric sequences at double stranded breaks (DSB). Since DSBs are induced during meiosis to promote homologous recombination, we wished to determine whether Pif1p plays a role during this process. Pif1p exists in two forms: nuclear and mitochondrial. Wild type *S. cerevisiae* strains express both forms of Pif1p. However, strains containing the *pif1-m1* allele only express the nuclear form of Pif1p, while strains containing the *pif1-m2* allele only express the mitochondrial form. We created *pif1-m2/pif1-m2* diploid strains to examine the effect of loss of the nuclear form of Pif1p on meiosis and sporulation. Our results indicate that *pif1-m2* strains have reduced sporulation efficiency relative to wild type strains. These data suggest that the nuclear function of Pif1p is not essential for meiosis. We are currently determining whether spores produced from a *pif1-m2* mutant are viable and show the expected segregation patterns. We are also quantifying Pif1p expression levels in wild-type strains undergoing meiosis. To determine expression levels of Pif1p throughout meiosis, cells will be synchronously sporulated and protein samples will be examined by western

Supported by NIH NIGMS MARC Grant T34 GM008021-28, Barry University.

4. Automation of image processing algorithms for the *ab initio* reconstruction of asymmetric particles by electron microscopy.

Christian Bureu[1], Rogelio Hernandez-Lopez[2], and Andres Leschziner[2] ([1]Department of Biology, Barry University, Miami Shores, FL; [2]Harvard University, Cambridge, MA)

lectron Microscopy (EM) is a powerful technique for generating 3D structures of biological specimens. In EM, images are collected from molecules adopting many orientations on a support (the EM "grid"). These images are computationally sorted out into groups representing the different characteristic views of the molecules present. To reconstruct a 3D image of the molecule, the relative orientations among these characteristic views must be known so that the images can be combined. Determining these relative orientations is a challenging step in EM and may be accomplished through analytical or geometric methods. Geometric methods are a robust way of determining these orientations because they rely on tilting the microscope stage to obtain two views of the same molecule, separated by a known angle. This known angular relationship is then used to generate a 3D structure. Random Conical Tilt (RCT) and Orthogonal Tilt Reconstruction (OTR) are the two available geometric methods. Three dimensional reconstruction involves a significant amount of image processing and bookkeeping that tends to be labor intensive, usually requiring a certain level of familiarity with computer programming. A set of scripts is being developed that will automate several of these processing steps. In addition to the timesaving aspect, the scripts will also eliminate user intervention at intermediate steps in the processing, making the algorithms accessible to inexperienced users.

Supported by a research fellowship from the SROH/MCO Summer Research Program at Harvard University, as part of the Leadership Alliance Consortium.

5. The *in situ* hybridization of the Polycomb gene in developing zebrafish (*Danio rerio*) embryos.

Susana Chan, *Stephanie Bingham, Gerhild Packert, Y.-W. Peter Lin, and Teresa Petrino (Department of Biology, Barry University, Miami Shores, FL)*

The *Polycomb (Pc)* group genes were identified in many species as a group of genes that maintains transcription patterns of homeotic genes during development. Previously, we have identified and cloned zebrafish *Pc1, Pc2* and *Pc3*. We hypothesize that these genes are differentially expressed during development. In order to determine the spatial and temporal expression patterns of the *Pc* genes in the zebrafish embryo, the isolated clones were used to synthesize antisense RNA probes to carry out in situ hybridization experiments. Zebrafish is an ideal model organism to carry out *in situ* gene expression studies in vertebrates because they develop externally and the embryo is translucent. ClustalW2 analysis was used in order to produce gene-specific probes, targeting unique sequences across all three *Pc* genes. In addition, as a positive control a probe recognizing the chromodomain, a conserved region among the three *Pc* genes was synthesized. Plasmids linearized with restriction enzymes SpeI or SphI were used as templates in transcription reactions with digoxygenin-labeled UTPs to obtain the sense (control) and antisense RNA probes that are currently being used for in situ hybridization analysis at various stages of development. Successful probe synthesis was confirmed via RNA gel electrophoresis. Adult zebrafish were placed in breeding tanks with a 2:1 female-male ratio under controlled photoperiod (14L:10D) and constant temperature 28.5°C. Embryos were collected, staged, and fixed at various developmental time points for the analysis of the developmental expression of the *Pc* genes. Determination of the expression profile of *Pc* genes will be an important step in understanding the role of these genes during embryonic development.

*Supported by MARC: NIH-NIGMS MARC U*STAR Grant, T34 GM008021 and DOE: No. DE-FG02-06CH11438, Barry University.*

6. Characterization of Plasmepsin 10 from *Plasmodium falciparum*.

Alec Davila[1], *Ben Dunn[2], Morgan McGuire[2], and Nathan Goldfarb[2] ([1]Department of Biology, Barry University, Miami Shores, FL; [2]Department of Biochemistry and Molecular Biology, University of Florida, Gainesville, FL)*

Malaria is responsible for 350-500 million annual cases of illness and an estimated 781,000 deaths worldwide in 2009. Four *Plasmodium* species cause malaria: *P. falciparum* (most lethal)*, P. malariae, P. ovale, and P. vivax.* These species are becoming resistant to current anti-malaria drugs making the identification of new therapies critical. The *P. falciparum* genome contains ten aspartic proteases called plasmepsins. Studies of single and double gene knockouts of proteases 1, 2, 4, and HAP revealed that these plasmepsins are non-essential for parasite growth and are therefore not candidate drug targets. However, plasmepsins 5, 9, and 10 are expressed intraerythrocytically suggesting a role in parasite transmission. The goal of this study is to gain insights into the activity of plasmepsin 10 in order to evaluate its potential as a drug target. The activity of the purified plasmepsin 10 was tested and determined to be inactive. Size exclusion chromatography revealed the protein was likely inactive due to misfolding. Future experiments will focus on promoting protein refolding by adjusting temperatures, pH levels, and incubation periods. Active plasmepsin 10 will be used in kinetic assays and x-ray crystallographic studies to reveal physical, structural, and biochemical properties and its potential as a malaria drug target.

Supported by UF-HHMI Science for Life, University of Florida.

7. An investigation of the methylation response following ethanol exposure in zebrafish.

Alec Davila, Anna-Lecia Lyn-Cook, Laura Mudd, and Stephanie Bingham (Department of Biology, Barry University, Miami Shores, FL)

Epigenetic factors lead to changes in gene expression without altering the DNA sequence. Associated modifications, primarily DNA and histone modification, are stable, heritable, and reversible. Disruptions in gene activity, and the disorders that arise as a consequence, can therefore either be the result of direct sequence alterations or changes in the epigenetic signature of these genes, or both. Alcohol exposure during development can cause growth, mental, and physical defects collectively known as fetal alcohol syndrome (FAS) or fetal alcohol spectrum disorders (FASD). The genetic mechanisms underlying these disorders are not fully understood, however, it is postulated that alcohol may induce abnormal epigenetic changes during embryonic development. DNA methylation is a type of epigenetic modification that is important to key developmental events including tissue regulation, genetic expression, development, and DNA repair. DNA methylation in humans is predominantly found at CpG dinucleotides. Due to DNA methylation's crucial role in genomic stability and other biological processes, an irregular regulation of DNA methylation may cause multiple human diseases. Both rodents and zebrafish have several characteristics which make them novel models to analyze the effects of ethanol exposure on neuronal development. The purpose of this project is to investigate the methylation response following ethanol exposure.

Supported by NIH MARC Grant T34 GM008021, Barry University; Department of Biology, Barry University; Department of Energy Grant DE-FG02-06CH11438.

8. The genetic analysis of circadian clock genes and major depression.

Precious de Verteuil[1], Marquitta White[2], Julie Pendergast[2], Shu Quin[2], Hugo Borsetti[2], Richard Shelton[2], Scott Williams[2], and Carl Johnson[2] ([1]Department of Biology, Barry University, Miami Shores, FL; [2]Vanderbilt University, Nashville, TN)

Major depression affects an individual's state of mind, giving a feeling of melancholy for extended periods of time. There is substantial evidence that depression has a significant genetic component (Snieder et al. 1997). Genes that have been hypothesized to affect susceptibility to depression include those that alter the molecular clock or circadian rhythm. These genes help to regulate many biological functions such as heart rate, blood pressure, and the sleep wake cycle (Waddington et al 2007).Thirty two SNPs in eight genes were assayed for their association with major depression in samples obtained from the National Institute of Mental Health (NIMH). A total of 1424 Caucasians samples (603 Cases and 821 Controls) were genotyped. After quality control that included screening for invariant SNPs, 19 SNPs and 1369 individuals (593 Cases, 776 Controls) remained for analysis. Analysis was done using a series of standard genetic epidemiological tests, including chi square, PRAT Analysis, Logistic Regression, and SNP - SNP Interaction. Two genes in the total data set were shown to associate with depression, *PER3* and *NPAS2* (odds ratio: 1.343 and p-value: 0.017 odds ratio: 0.853 and p-value: 0.045 respectively). In our analyses there was also evidence for different associations in males and females. Specifically, there is a significant interaction between MTNR1B, melatonin receptor 1, and gender. The allele that associates in females with decreased risk of depression (odds ratio: 0.829 p-value: 0.036) trended in the opposite direction in males (odds ratio: 1.262 p-value: 0.179). CLOCK, Circadian Locomotor Output Cycles Kaput, the C allele is protective only in males only (odds ratio: 0.659 p-value: 0.038). These results suggest that variants in the several circadian rhythm genes are associated with major depression, but that their effects differ by gender.

Supported by NIH MBRS RISE R25 GM059244, Barry University.

9. An Investigation of hindbrain patterning in zebrafish palmitoyl-protein thioesterase-2 morphants.

Nella Delva[1], Gabriela Toro[1], Elizabeth Nguyen[1], Vinoth Sittaramane[2], Stephen Ekker[3], Anand Chandrasekhar[2], and Stephanie Bingham[1,2] ([1]Department of Biology, Barry University, Miami Shores, FL; [2]University of Missouri-Columbia; [3]Mayo Clinic, Rochester, MN)

Neuronal ceroid lipofuscinoses (NCL) is a group of neurodegenerative syndromes characterized by lysosomal failure to break down lipids, and their subsequent accumulation in vital organs such as the liver, spleen, heart and brain. As a consequence, organ system dysfunction and failure occur. Here we characterize nervous system defects that arise in response to palmitoyl protein thiosterase-2 (*ppt2*) knockdown – an enzyme implicated in several forms of NCL and which plays a critical role in the hydrolysis of long chain fatty acyl CoA. Zebrafish *ppt2* is expressed broadly in the nervous system during development. Knockdown of *ppt2* using a translation-blocking morpholino results in widespread autofluorescent lysosomal storage material localized to the cytoplasm, a phenotype consistent with that of the PPT2 knockout mouse. In addition, nervous system defects including impaired facial branchiomotor neuron migration and vagal motor neuron expansion, are observed. Uncharacteristically, many of these branchiomotor neurons exit the neural tube ventrally at the level of rhombomere 4, a phenotype similar to that of integrin α6β1 morphants, suggesting cell adhesion mechanisms may be disrupted in these embryos. Furthermore, numerous populations within the hindbrain and spinal cord display highly defasciculated and stunted axon phenotypes. These results suggest zebrafish may be used as a model for NCL studies.

Supported by MBRS RISE Grant MBRS RISE:R25 GM059244, Barry University; NIH Diversity Supplement to NS0449; Life Sciences Undergraduate Research Opportunity, University of Missouri-Columbia.

10. Identification of synthetic lethal interactions between *cdc13-1* and *yku80* mutant alleles in *S. cerevisiae*.

Sue-Ann Flores, Lauren Sanchez, Gina Guillaume, Maxime Jean, Wesam Azaizeh, Ana M. Jimenez, Christoph Hengartner, and Leticia Vega (Department of Biology, Barry University, Miami Shores, FL)

Telomeres are the physical ends of eukaryotic chromosomes that function to protect DNA ends from degradation and from end to end fusion. Telomeres consist of stretches of repeated C/G-rich DNA ending with 3' single stranded G-rich overhangs. The maintenance and function of telomeres are facilitated by the enzyme telomerase and by accessory proteins such as Ku and Cdc13p. Cdc13p is an essential, G-strand binding protein that functions in telomere protection and in telomerase recruitment. *cdc13-1* is a temperature sensitive allele of *CDC13*, that is defective for telomere end protection. Ku is a non-essential heterodimer composed of Ku70p and Ku80p. Ku plays multiple roles in DNA metabolism including: non-homologous end joining, recombination and end protection. Ku also interacts with TLC1, the RNA template of the telomerase enzyme and has recently been shown to exhibit end-binding activity. This study examines the effect of mutations in *yKU80* on *cdc13-1* strains. We will also determine genetic interactions between yku80 mutants and Pif1p, a helicase that inhibits telomerase activity. We previously showed that *cdc13-1* strains deleted for *PIF1* display hyper-elongated telomeres and increased temperature resistance. Telomere elongation in *cdc13-1*, *pif1*Δ strains partially depends on the Ku-TLC1 interaction. Using a genetic library of *yku80* mutations generated in the Bertuch lab, we have introduced the *yku80* alleles into the *cdc13-1* background. The goal of these experiments is to determine the effects on viability and telomere end protection of the various *yku80* mutant alleles in *cdc13-1* strains. We hope to identify a *cdc13-1*, *yku80* double mutant that mimics the phenotypes of *cdc13-1*, *pif1*Δ strains. To date

9 out over 70 *yku80* alleles tested were found to increase the temperature sensitive phenoytype of *cdc13-1* strains, suggesting a telomeric/end protection role for these *yku80* alleles.

Supported by NIH-NIGMS MBRS RISE Grant: 2R25 GM059244-10, Barry University and NIH-NIGMS/NCI MBRS SCORE grant, 5S, Barry University.

11. Validation and optimization of multiplex bead assays for measurement of cytokines in human samples.

Talia Guardia[1],Troy Kemp[2], and Ligia Pinto[2] ([1]Department of Biology, Barry University, Miami Shores, F; [2]National Cancer Institute-Frederick, Frederick, MD)

Cytokines are proteins that are secreted by many cells, such as those directly and indirectly involved with innate and adaptive immunity. One of the methods for studying cytokines is using multiplex bead technology; however, there are various components of this technology that need to be examined prior to implementation for clinical studies. The overall purpose of this study was to determine assay stability and optimal sample conditions for the measurement of cytokines in human samples. The results for the multiplex bead assay stability study showed that there was a less than 10% change in cytokine measurement between immediate and post-20 hours data acquisition. According to the freeze-thaw cycle data, the majority of the cytokine measurements, except for IL-1ß, IL-2, IL-7, IL-12(p40), and sIL-2Ra, displayed a less than 10% decrease in concentration compared to the reference sample (1 freeze-thaw cycle). Also, many of the cytokine levels displayed a less than 10% decrease in cytokine concentration when stored at 4°C compared to the reference sample (2 hours at 4°C), except for GRO and sCD40L. In conclusion, cytokines within the four Millipore Milliplex panels were stable for up to 20 hours following protocol completion. Furthermore, many of the cytokines associated with Cytokine Panel I (22-plex) maintained their integrity for up to 6 freeze-thaw cycles and 48 hours at 4°C. Future studies will be needed to evaluate cytokines on a larger population of samples to further support our findings.

Supported by NIH MBRS RISE R25 GM059244, Barry University.

12. A puzzle in TGFß-mediated cdk activity in human myeloid leukemia cells.

Talia Guardia, Alejandra Toro, Reshma Baddaloo, Shakima St. Clair, Graham Shaw, and Xiaotang Hu (Department of Biology, Barry University, Miami Shores, FL)

We have previously reported that Transforming Growth Factor-beta (TGF-ß) significantly inhibited growth of several human myeloid leukemia cell lines including TF-1 and MV4-11 cells. Cell cycle analysis indicated that these cells were arrested in G1 phase by TGF-ß. We also found that several cell cycle regulated protein kinases (CDKs), such as CDK4 and CDK2, were significantly downregulated. In contrast, p27, one member of cdk inhibitors, was clearly upregulated. It is well documented that the inhibition of CDKs is a result of the binding of the cdk inhibitors in response to TGF-ß. The CDK inhibitors have two families: CIP/KIP and INK. The CIP/KIP members consist of p21, p27 and p57. The Kip/Cip inhibitors can bind to and inhibit both cyclin D-cdk4/6 and cyclin-E/A-cdk2 kinases. The INK members consist of p15, p16, p18 and p19. The Ink inhibitors only bind to and inhibit cdk4 and cdk6. In this study, we detected an enhanced level of p27 in TGF-ß treated cells; however, we were not able to detect the expressions of p15, p16, p19, and p57. Although the cells barely expressed p21, the treatment of cells with TGF-ß had no effect on the expression of the molecules. Since p27 has been reported to have both positive and negative roles on cdk activities, our data suggest that the cdk inhibitors we tested may not play an important role in TGF-ß-mediated growth and cdk inhibition in these human myeloid

leukemia cells. The mechanism for the CDK inhibition in the presence of TGF-ß is still a puzzle. Some other molecules that may negatively regulate CDK activities in the cells tested remain to be identified.

Supported by NIH-NIGMS MBRS RISE: R25 GM059244, Barry University.

13. Gene transcription and protein expression controlling the regenerative remodeling of zebrafish hearts.

Nicole H. Lopez, Joshua D. Tapia, Precious A. de Verteuil, and Brenda Schoffstall (Department of Biology, Barry University, Miami Shores, FL)

Unlike human hearts, zebrafish (*Danio rerio*) hearts have the capacity to regenerate functional ventricular tissue via hyperplasia. A similar remodeling process occurs in zebrafish during heart enlargement in response to cardiac overload stress. To identify specific gene products involved in this remodeling process, we completed a survey of gene expression from heart tissue of *Danio rerio* that had been forced to endure a 10-week period of regular, strenuous swimming exercise. Following RNA extraction and reverse-transcriptase preparation of cDNA, we compared microarray expression data for zebrafish hearts between control (non-exercised) and exercised fish hearts. Using this data, we established specific categorical groups of genes and gene products, and specifically identified five up-regulated genes involved in cell division and differentiation. In addition, we used Western blot to examine our remodeled heart samples for protein expression levels of GATA4 and Thymosin ß4, two proteins of interest that have been shown to be highly expressed during the cardiac repair process. We found that while GATA4 expression appears to be higher in exercised hearts, Thymosin ß4 expression is lower. Future studies will involve taking samples at various time points during the regenerative process, rather than after the heart is fully remodeled, to observe the molecular changes that occur in compensating zebrafish hearts. Identification of specific gene products involved in signaling the regenerative remodeling response to stress in zebrafish hearts could provide specific therapeutic molecular targets for the prevention of pathological cardiac hypertrophy in humans.

Supported by NIH MBRS RISE R25 GM059244 and DOE: No. DE-FG02-06CH11438, Barry University.

14. A laboratory breeding colony of Leiobunum sp. Harvestmen (Opiliones, Arachnida).

Nicholas Morales, Brenda Schoffstall, and Jeremy R. Montague(Department of Biology, Barry University, Miami Shores, FL)

Harvestmen of Genus Leiobunum are a common but little studied group of so-called “daddy-long-leg” arachnids. Harmless to humans, they probably play an important role in the small-bodied predator and small-bodied scavenger trophic links within urban ecosystems, yet they receive scant attention from researchers. Since September 2011 we have housed several dozen opiliones (we affectionately call them “our opies”) in plastic lab terraria each containing soil, some leaf litter and a moistened sponge. A particular population of 18 Leiobunum sp. FedExed to us in early October 2011 by a friend in North Carolina has been maintained on a diet of dead ants, squashed crickets and small bits of apple. We observed some Leiobunum courtship and mating, and on 18 November 2011 we found one small clutch of 25 whitish eggs, each approximately 0.7 mm in diameter. We gently removed approximately 13 of these eggs, washed them with 1X PBS and placed them onto moist filter paper in a smaller plastic container. Within ten days the developing eggs displayed prominently darkened eyes and showed long legs wrapping around the embryo. On 2 December 2011 we found and photographed a live and very active Leiobunum hatchling in the small container; we also noted a dead hatchling. Of the original 18

Leiobunum adults, only one survived into mid-December. We hope to establish one day a sustainable breeding colony of these fascinating animals.

Supported by the NIH-NIGMS MARC: T34 GM008021 and the NIH-NIGMS MBRS RISE: R25 GM059244 awards, Barry University.

15. The effect of embryonic ethanol exposure on zebrafish development.

Sandra Richardson, Marcela Toro, Danae Brierre, Nella Delva, Christine Lynch, Anna-Gaye Nicholson, and Stephanie Bingham (Department of Biology, Barry University, Miami Shores, FL)

As an organ system that begins development early in embryogenesis and continues development throughout embryogenesis and postnatally, the nervous system is particularly vulnerable to teratogen exposure. It has been documented that prenatal exposure to ethanol may result in developmental delays and severe cognitive deficits, known collectively as Fetal Alcohol Syndrome or Fetal Alcohol Spectrum Disorders. We are investigating the effects of ethanol exposure by treating zebrafish embryos at different stages of development, and for different periods of time. Preliminary results confirm previous findings of cardiac and morphogenetic defects as well as new evidence of nervous system defects even in the absence of obvious morphological changes.

Supported by Department of Biology, Barry University; Faculty Incentive Grant; Barry University; Research mini-grant, Barry University; Department of Energy Grant DE-FG02-06CH11438.

16. Understanding the genetic mechanisms of cold tolerance in *Drosophila melanogaster*.

Lauren Sanchez[1] and Clandinin Thomas[2] ([1]Department of Biology, Barry University, Miami Shores, FL; [2]Department of Neurobiology,Stanford University, ,Stanford, CA)

Insects are ectotherms with limited ability to regulate body temperature. However, in response to cold environments, insects have multiple adaptive strategies to ensure survival, including freeze tolerance and freeze avoidance. Currently, genetic mechanisms underlying cold survival in insects are unknown. We examined the cold tolerance of *Drosophila melanogaster* isolates obtained from different climates and found that they displayed significant variation in their ability to survive at 4°C. Strains from Nagano, Japan and Ica, Peru displayed increased survival relative to an isogenized control line (IsoDG). Given the phenotypic variation, we wanted to examine whether there was a genetic basis for increased cold tolerance. To do this, we crossed different isolates, and examined the survival of F_1 and F_2 animals. Survival curves were generated for the F_1 and F_2 progeny of IsoDG mated with flies from Nagano, Japan and Ica, Peru. F_1 flies showed enhanced cold tolerance similar to the Ica and Nagano parental strains, suggesting that increased cold tolerance is dominantly inherited. Subsequently, F_2 flies were selected for the increased cold tolerance phenotype. DNA from selected flies was pooled for whole genome sequencing, an approach that will allow us to determine which genes are associated with increased survival. Future directions include characterizing the genes responsible for cold tolerance and mating lines from different locations with varying cold tolerance to establish whether increased cold tolerance has a common genetic origin.

Supported by NIH-NIGMS RISE Grant, R25 GM059244, Barry University.

17. A karyotyping approach to understanding zebrafish development.

Nicole Schtupak, Chris-Ann Xavier, Christina Dampman, and Stephanie Bingham (Department of Biology, Barry University, Miami Shores, FL)

The cell division process is characterized by the equal division of genetic information stored in chromosomes. In some cases, however, this process fails to occur normally. As a consequence of this unequal distribution of chromosomes among daughter cells (nondisjunction), the result is the condition broadly known as aneuploidy. Birth defects arising from nondisjunction can be attributed to 10-35% of live births each year in the United States. Nondisjunction errors are responsible for a variety of chromosomal abnormalities in both human and other animal species and, the leading cause of miscarriage, mental retardation, and birth defects. Aneuploidies resulting from nondisjunction errors produce syndromes such as Trisomy 21 (Down's syndrome), Trisomy 18 (Edward's Syndrome), Trisomy 13 (Pateau's Syndrome) and Turners Syndrome (45-X). Resulting phenotypes vary depending on the chromosome involved and the extent of the aneuploidy. *Danio rerio* is a widely used model system among several of biological disciplines and has become one of the most preferred models of vertebrate research. We are using zebrafish as a model for studying the correlation between aneuploidy events and the incidence and severity of morphological defects in the embryo.

Supported by Department of Biology, Barry University; Department of Energy Grant DE-FG02-06CH11438.

18. Regenerative remodeling of zebrafish hearts in response to long term regular exercise stress.

Joshua Tapia, Nicole H. Lopez, Precious de Verteuil, and Brenda Schoffstall (Department of Biology, Barry University, Miami Shores, FL)

Human hearts are incapable of effectively replacing damaged cardiac tissue. Although there is a low level of cell division that occurs, it is insufficient to repair any damaged cardiac tissue. *Danio rerio* (Zebrafish) cardiomyoctyes are able to proliferate, making them a marvelous model to study heart regeneration processes. Because zebrafish exhibit this regenerative response, we hypothesized that the zebrafish response to cardiac overload stress would be similar: heart enlargement via hyperplasia rather than hypertrophy (as in humans). To determine if the zebrafish heart response to cardiac overload stress is enlargement via hypertrophy or hyperplasia, we subjected zebrafish to a 10-week forced swimming exercise regimen, and then examined the hearts for physiological function and histological evidence of cell proliferation. Using a custom-made swimming exercise "treadmill" tank, zebrafish were forced to swim against a powerful current at ~25 cm/second for up to 1 ½ hours, twice daily for a total period of 10 weeks. At the end of 10 weeks, individual fish were then measured for overall size, and fish hearts were observed for heart rate, ventricular surface area, and percent shortening fraction. Using immunohistochemistry, we specifically labeled cardiomyocyte nuclei and probed for proliferating cell nuclear antigen (PCNA) to determine if the remodeled tissue enlarged due to hypertrophy or hyperplasia, and if the cells were actively undergoing division at the time of sacrifice. Our results indicate that fully remodeled zebrafish hearts enlarge in response to stress via regenerative hyperplasia. Future studies will include taking sample hearts at various time points during remodeling to observe expression of proliferation proteins. Full understanding of the zebrafish regenerative response to cardiac overload stress may lead to future identification of genes or proteins that have therapeutic effects in humans with various types of cardiac stress that lead to pathological hypertrophy.

Supported by NIH MBRS RISE R25 GM059244 and DOE: No. DE-FG02-06CH11438, Barry University.

19. Mitochondrial DNA haplogroups and forensic correlations.

Terry Thomas and Gilbert Ellis (Department of Biology, Barry University, Miami Shores, FL)

The energy producing organelle mitochondria is very unique and has been a valuable source in forensic analysis since the early 1990's. The organelle houses a distinctive DNA molecule (mtDNA) in a ring-like structure that is approximately 16,569 base pairs long. The molecule has a coding region that provides functional gateways for biochemical products related to providing energy to the cell. Furthermore, mtDNA has control regions known as hypervariable region one (HV1) and hypervariable region two (HV2). These regions of the molecule yields variation among humans. From these regions we may draw facts from ones ethnic background and we can correlate the findings to crime scene evidence. "Ethnicity plays an important role in forensic investigation and can be inferred with the help of genetic markers" (Lee, Mandoiu, Nelson, 2011). This research will examine the validity of the ethnic mtDNA haplogroups, also supporting the initiation of an mtDNA ethnic database. Serving as a tool contributing to government institutions and can assist forensic anthropologist to identify deceased individuals whose remains are unrecognizable and cannot be linked through nuclear DNA. Furthermore, the database can serve as a tool used correlate suspects to crimes and exonerate individuals. Current population testing methods of ethnic haplogropus in the hypervariable strands has proven to be accurate and can only yield beneficial advances in forensic studies.

20. Localization of Dex-propylamine-1X in PC-3 and RWPE-1 prostate cells.

Alejandra Toro[1], David Nanus[2], and Gunjan Gahkar[2] ([1]Department of Biology, Barry University, Miami Shores, FL; [2]Weill Cornell Medical College, New York, NY)

We examined the selectivity of Dex-propylamine, a dextran-based biosynthetic polymer designed with free propyl amine groups, to metastatic cells. This compound was synthesized in Dr. Chu's Lab at Cornell University. We hypothesized that the polymer's cationic properties would result in a high affinity for the negatively charge membranes characteristic of metastatic cancer cells. In order to determine the localization inside the metastatic prostate cancer cell line PC-3, and the normal prostate epithelial cell line RWPE-1, cells were seeded at 100,000 cells/well in a 48-well plate, and treated with 100 µg/mL of Dex-propylamine at four different time points: 0.5h, 1h, 2h, and 5h. The cells were incubated in RPMI and 10% fetal bovine serum, at 37°C and 5% carbon dioxide. Image analysis showed that there was a significant uptake of the polymer by approximately 69% percent of PC-3 cells, at 2h and 5h. Furthermore, we determined that Dex-propylamine, was localized in the cytoplasm of these metastatic cells. Remarkably, we were unable to observe a significant uptake of the polymer by the non-metastatic RWPE-1 cells. Our data suggest that Dex-propylamine is target specific to the metastatic cancer cell line, and therefore has the potential to be used as a drug delivery tool.

Supported by Summer Traveler's Research Fellowship, Weill Cornell Medical College.

Department of Mathematics and Computer Sciences

21. Toward improving computer performance using parallel programming.

Orin Harris, Wadner Joseph, and Chakib Chraibi(Department of Mathematics and Computer Science, Miami Shores, FL)

For more than fifty years, computer performance has relied on guaranteed hardware capacity growth enshrined in Moore's law. This trend is now coming to an end. Recently, there is a renewed interest in parallel programming as a way to continue this sustained growth, especially, as multi-core processors,

consisting on two or more independent processors, are common in all types of computing devices. The purpose of this research is to experiment with the effectiveness of parallel over sequential processing and determine if it is a reliable alternative to hardware density. The same computational task will be executed using both models: sequential processing and parallel processing. The execution will be carried out using different algorithms of varying complexities. The time performance will be measured and analyzed. Then, the results will be used to compare and predict the future of parallel computation.

22. American sign language pattern recognition: an embedded design approach.

Wadner Joseph, and James Haralambides (Department of Mathematics and Computer Science, Miami Shores, FL)

This work is an effort to recognize a subset of characters of the American Sign Language (ASL) dynamically using programmable logic. Pattern recognition takes place on a Spartan 3e educational board using an embedded design approach. A camera connected to a computer and activated by software will capture a snapshot of the end user's hand sign placed in front of a uniform background. The image will go through a number of preprocessing steps including: edge detection, computing of its geometric center, outline normalization, and conversion to a byte stream. Following these transformations, a histogram will retain information about certain characteristics of the stored sign character. Such characteristics are related to the location (distance from geometric center) and orientation (angle of the pixel with respect to the horizontal) of its outline pixels produced through edge detection. Finally, the image is transmitted to the Spartan 3e FPGA board using an RS-232 serial port and is stored to available block RAM. Characters of the sign alphabet are preprocessed and stored on the FPGA board's block ROM to increase the execution time efficiency of the design. These characters have been captured and preprocessed following the same approach that was used on the dynamically captured sign. An iterative correlation process applied between the histogram of the captured image and the histograms of the stored images of the sign characters yields an optimal match. A graphical representation of the resulting sign will be forwarded to an LCD monitor using the FPGA board's VGA port.

23. Artificial intelligence from a Christian perspective.

Danny Levons, and Carlos Segami (Department of Mathematics and Computer Science, Miami Shores, FL)

Theologically, the soul may emerge from both mental and bodily processes. Christianity allows the possibility of Artificial Intelligence. Christian education teaches that human specialness is not defined by what human beings actually are, but instead what God intends for them to be. Christianity's insight can potentially help to suggest how artificial intelligence can be achieved with realistic human limits. The idea of creating technology that becomes smarter-than-human has been a topic of concern since the beginning of Artificial Intelligence. Some of these technologies are more easily produced than others, while all remain at a threshold that still prevents the creation of smarter-than-human intelligence. In this presentation, we will discuss some of the most famous philosophical arguments for and against the possibility of creating intelligent machines, including the Christian perspective. We will also briefly present the current state and current developments of Artificial Intelligence and what may lie ahead.

24. Dynamic image spherization using programmable logic.

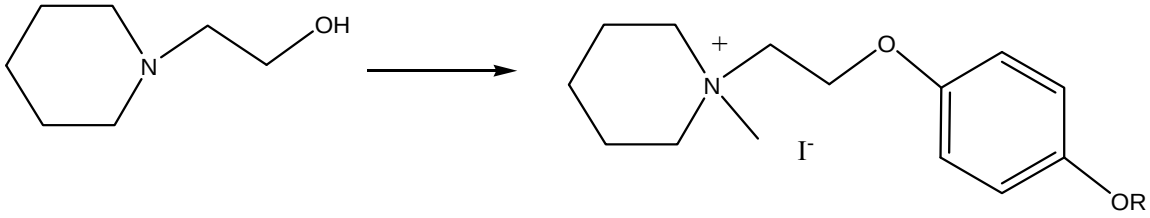
Hugo Torres, Reynaldo Pino, and James Haralambides (Department of Math and Computer Science, Barry University, Miami Shores, FL)

Spherization involves mapping of an image on the surface of a sphere. The filter produces a distorted 3-dimensional look of the image. Using basic trigonometrical functions, we can produce a spherization formula that maps pixels of the original image to new locations. Assuming the center of spherization is placed at the center of the image, the angle formed between the line connecting a pixel and the center of the image and a horizontal line remains unchanged. On the other hand, the distance of the pixel from the center of the image is modified to reflect the spherization effect. This process involves a fair amount of calculations and a hardware implementation may speed up the mapping process by a substantial amount of time. We have implemented the spherization effect using Field Programmable Gate Arrays (FPGAs). A Spartan 3e board has been used to test the implementation,. The original image is captured dynamically using a webcam and a computer. The image is processed at the pixel level to adhere to the color requirements of the FPGA board. All pixel information is then transmitted to the FPGA board using an RS-232 transmission (serial port) and stored in the board's block RAM. It is subsequently processed to produce the spherized equivalent. The amount of calculations is reduced by calculating the modified pixel distances from the center of the image using a tabular process. The resulting image is sent to an LCD monitor through a VGA port.

Department of Physical Sciences

25. Synthesis of n-substituted piperidinyl quaternary ammonium salts for Alzheimer's applications.

Jeffrey Andreas and John Boulos (Department of Physical Sciences, Barry University, Miami Shores, FL)



Alzheimer's disease is a neurodegenerative disorder characterized by loss of memory, judgment, language functions and loss of specific neurons which project from the basal forebrain to the hippocampus and cerebral cortex. Degeneration of these nerve cells results in a decrease of neuronal markers such as the universal neurotransmitter acetylcholine. The cholinergic hypothesis is based on the fact that, while basal forebrain neurons which express the M2 muscarinic receptor are at risk of degenerating, the cortical neurons expressing the M1 subtype which synapse with them are not altered. In theory, one could design and synthesize muscarinic selective M1 agonists that would activate the cortical neurons. This research involves the discovery of selective cholinergic drugs that would mimic the effects of acetylcholine at M1 post-synaptic neurons, thus enabling to reverse memory loss associated with Alzheimer's disease. Several heterocyclic salts are being synthesized in which piperidine is substituted at the nitrogen atom with a phenyl substituent bearing an alkoxy-group at the para position. These compounds could be potential M1 selective agonists for the symptomatic treatment of Alzheimer's disease. The synthesis is a four part process beginning with the reaction of piperidine with 2-bromoethanol. The N-substituted piperidinyl alcohol, so obtained, is converted to the corresponding alkyl chloride with triphenyl phosphine and carbon tetrachloride. The resulting alkyl chloride is then treated with p-butoxy phenoxide ion, and then methylated to form the corresponding quaternary ammonium salt.

26. Preparation of organo-silica monolithic column for application in capillary liquid chromatography utilizing azobisisobutyronitrile at 365 nm.

Launie Bruno[1], Jill Dvornik[1], Frantisek Svec[2], Zuzana Zajickova[1] ([1]Department of Physical Sciences, Barry University, Miami Shores, FL; [2]The Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, CA).

Capillary high performance liquid chromatography is a separation technique used widely in biochemistry and analytical chemistry in applications such as characterization of unknown mixtures and proteome research, mostly in combination with mass spectrometry. A monolith is a single piece of material with interconnected skeletons and highly permeable through pores, which serves as a very efficient separation medium in liquid chromatography. Monolithic columns typically consist of silica or cross-linked organic polymer. In this study, photopolymerized organo-silica hybrid monolith was prepared using simultaneous sol-gel transition and photopolymerization of a mixture of 3-(trimethoxysilyl)propyl methacrylate (MPTMS), an aqueous acid catalyst (0.12 M HCl), a porogen (toluene), and a photoinitiator (azobisisobutyronitrile, AIBN). This homogeneous solution was irradiated at 365 nm directly within the confines of a pretreated fused silica capillary (100 μm I.D.). The resulting porous monolith enabled separation of thiourea and benzene under three minutes.

*Supported by the National Science Foundation CBET-1066113 and NIH-NIGMS MARC U*STAR grant, 5T34 GM008021, Barry University.*

27. Perfluoropolyether, a fluorine cell labeling agent.

Susana Chan[1], Hongyan Xu[2], Michael J. Patrick[2], Bistra Iordanova[2], and Eric T. Ahrens[2] ([1]Department of Physical Sciences, Barry University, Miami Shores, FL; [2]Carnegie Mellon University, Pittsburgh, Pennsylvania)

Cellular therapy introduces pharmacologically manipulated cells into the body to battle different pathologies. However, it is difficult to quantify the number of therapeutic cells and if they are in the targeted area. Therefore, there was still a need for a non-invasive method of cell tracking. Ahrens' lab synthesized a stable and non-toxic fluorine-labeling agent, perfluoropolyether (PFPE) nanoemulsion that can be detected using ^{19}F Magnetic Resonance Imaging (MRI). In addition, PFPE was further conjugated with a fluorescent dye, mixed together with pluronic F68 (detergent used as cell membrane stabilizer) and polyethyleneimine (PEI) in a microfluidizer to ensure small droplet size. The prepared nanoemulsion was tested on different cell lines *in vitro* to determine the cellular uptake using ^{19}F Nuclear Magnetic Resonance (NMR). The labeled cells were introduced to a mouse model to track the movement of the cells using ^{19}F MRI. The size of the nano-droplets was determined using Dynamic Light Scattering. Furthermore, it was observed that upon fluorine labeled cell death the nanoemulsion was able to re-enter neighboring cells, but the amount was minimal. Since the secondary labeling is minimal and PFPE is non-toxic and easily traceable with ^{19}F MRI, it can someday be applicable to in vivo cell tracking.

*Supported by MARC: NIH-NIGMS MARC U*STAR Grant, T34 GM008021, Barry University.*

28. Quantitative analysis of the axes-exchange question in the linear fit analysis.

Renee Forcier, Maurizio Giannotti, and John F. Goehl (Department of Physical Sciences, Barry University, Miami Shores, FL)

Exchanging the axes in a linear fit generates different values for a physical parameter, a fact largely overlooked in the standard literature. To our knowledge, this problem has never been analyzed quantitatively. We did the analysis and showed that, surprisingly, the difference in the values obtained for the physical parameter is not necessarily small. Depending on the set of data points, this difference can be bigger than the uncertainty in the parameter and therefore cannot be rounded off.

29. Preparation of organo-silica monolithic column for application in capillary liquid chromatography using photopolymerization.

Deepa Gharbharan[1], Afua A. Gyapong[1], Frantisek Svec[2], Zuzana Zajickova[1] (1Department of Physical Sciences, Barry University, Miami Shores, FL; [2]The Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, CA)

In high performance liquid chromatography, there is a trend of replacing conventional particle-packed column with capillaries containing highly porous monolithic separation media. Major advantage of using this technique is the achieving the separations at shorter time allowing high throughput analyses. The aim of this study is to develop a hybrid monolith combining both inorganic and organic building blocks using light as an initiator. This process was done by filling the pretreated UV transparent capillary with a homogeneous solution that consisted of 3-(trimethoxysilyl)propyl methacrylate, a catalyst (0.12 mol/L hydrochloric acid), a porogen (toluene), and a photoinitiator (2,2-dimethoxy-2-phenylacetophenone). The filled capillary was irradiated during the sol-gel transition at 254 nm and energy of 900 mJ/cm^2 to initiate polymerization reaction of the methacrylate functionalities. The presence of the hydrophobic organic polymer on the pore surface of the monolith was confirmed through ability of the resulting stationary phase to separate alkylbenzenes under isocratic conditions.

Supported by the National Science Foundation CBET-1066113, Barry University

30. The synthesis, characterization and kinetic degradation study of di-creatine maleate followed by Nuclear Magnetic Resonance (NMR).

Brittany Kuhl and Tony Wallner (Department of Physical Sciences, Barry University, Miami Shores, FL)

Creatine monohydrate is widely found within the nutrition and fitness industries as a nutritional supplement. Its popularity has grown due to correlations between creatine usage and increased muscle size, endurance, and performance. There are also several studies being conducted on the therapeutic use of creatine monohydrate for various neuromuscular disorders and type II diabetes. Due to its moderate solubility (16 mg/mL) creatine monohydrate has limited bioavailability in therapeutic applications. This work investigates the synthesis of a new creatine salt derivative, di-creatine maleate, to increase creatine monohydrates' bioavailability. Optimum yield for this compound was obtained during a study using various reaction conditions (temperature, solvent, methodology). The compound was characterized with physical constants (M.P. and solubility), NMR and elemental analysis. The new compounds' kinetic degradation was studied for 30 days and compared to the degradation of creatine monohydrate and commercial dietary supplements (Encharge™, Kre-Alkalyn EFX PRO™, Creaform and Creatine monohydrate GNC Pro Performance®) at room temperature in the presence of an internal standard 4-(2-aminoethyl)benzene-sulfonamide.

31. Review and analysis of the properties, synthesis, and biomedical applications of gold nanorods.

Daniel Morales *(Department of Physical Sciences, Barry University, Miami Shores, FL)*

The purpose of this paper is to offer a synopsis of the properties, synthesis, and biomedical applications of gold nanoshells (GS). For this end, thirty primary and peer-reviewed articles were consulted and their key results are presented here. First, the physics behind the interactions of electromagnetic radiation with the surface of the gold nanoshells is analyzed, followed by an overview of the synthetic steps involved in their formation. Then, some key biomedical applications of GS are reviewed, particularly photo-thermal therapy for the treatment of cancerous cells and tissue imaging. All the studies show that gold nanoshells convert near-infrared wavelengths of light into heat. These results support the idea that the heat generated induces cancerous cell death via apoptosis. Condensing the significant literature published on the properties, synthetic methods, and biomedical applications of gold nanoshells will allow easier access to the pertinent information and lead to a more comprehensive understanding of these topics by future researchers.

32. Blue stars as a laboratory for fundamental physics.

Aaron Mohammed[1], Maurizio Giannotti[1], Michael Wise[1], and Alex Friedland[2] ([1]Department of Physical Sciences, Barry University, Miami Shores, FL; [2]Theoretical Division, T-2, MS B285, Los Alamos National Laboratory, Los Alamos, NM)

Stars with masses a few times the mass of the sun evolve into a stage known as the blue loop, during which their surfaces become hotter and, consequently, bluer. Stars in this stage can be easily observed with modern space-based telescopes. We studied this stage numerically using a new computer especially assembled for this purpose. We show how this stage is very sensitive to the underlying physics, and can therefore be used to test fundamental processes.

33. Partial synthesis of taxol.

Dieudonne Pierre-Louis *(Department of Physical Sciences, Barry University, Miami Shores, FL)*

In an effort to assuage the rampant growing of cancer in the United States in 1963, chemotherapeutic drug Paclitaxel (trade name Taxol) has been studied. This study was the first to use yew plants of the family of taxanes and extracts of these plants were evaluated for anticancer treatments by the National Cancer Institute. The synthesis of Taxol took forty years and still remains an ongoing process. The biosynthetic investigation to this drug shows a pathway consisting of twenty steps with a molecular weight of 854 grams per mole. Although many scientists have developed different methods of synthesizing this compound they all ended with the same conclusion: a backbone composed of twenty-carbons and the addition of a beta amino acid side chain. In this review, I will be focusing on the synthesis of the tail addition. What makes Taxol the drug of choice in cancer treatment is its ability to treat different types of cancer such as lung, breast, and ovaries cancer. This is a characteristic that most anticancer drugs lack. Moreover, I will be reviewing the effect of Taxol on normal and cancer cells in the microtubule.

34. Photopolymerized preparation of hybrid monoliths.

Brittny Randolph and Zuzana Zajickova (Department of Physical Sciences, Barry University, Miami Shores, FL)

The chemistry, development, characterization and application of organo-silica hybrid monolithic columns are described and validated for use in high performance liquid chromatography (HPLC). Monoliths are well known highly porous and permeable separation materials which allow mass transfer of analytes through a stationary phase in a chromatographic column. While the application of monolithic capillaries is a relatively new discovery, analytical chemists have spent the last few decades improving their resistance to flow and permeability while maintaining desirable column efficiency. In our research organo-silica hybrid monolithic columns were prepared in pretreated 100 μm internal diameter (ID) fused silica capillaries via the one-step *in situ* polymerization of a solution of the monomer ([3-(trimethoxysilyl)propyl] methacrylate), catalyst (aqueous hydrochloric acid), porogen (toluene), and photoinitiator (azobisisobutyronitrile). Capillaries were irradiated at a wavelength of 365 nm and energy of 900 mJ/cm^2. The homogeneous formation of hybrid monolith within the capillary was observed utilizing optical microscopy. Chromatographic characterization was achieved by separation of thiourea and benzene in isocratic mode with resulting 2900 plates pre meter.

Supported by the National Science Foundation CBET-1066113, Barry University.

35. Proposed green oxidation methods for porphyrin synthesis.

Hannah Shy and Tamara D. Hamilton (Department of Physical Sciences, Barry University, Miami Shores, FL)

Solvent-free chemistry has become popular because of the increased emphasis on waste reduction and lessening cost. In addition, eliminating the use of solvent can allow products with little to no yield to be produced more efficiently. Porphyrins are cyclic, organic compounds that have become extremely important in the construction of larger, self-assembled systems. The traditional synthesis of porphyrins consists of an acid-catalyzed condensation of pyrrole and aldehyde to produce a precursor: porphyrinogen, which is then oxidized to become porphyrin. The traditional process is inefficient with yields lower than 30%. In addition, it requires high-dilution solvent conditions to ensure the proper reaction takes place. Large amounts of solvent must be used to produce a small amount of product. We have been successful in developing a solvent-free approach, wherein solvent can be eliminated completely, therefore doing much less harm to the environment. In our method, pyrrole and benzaldehyde are ground together in the presence of an acid to produce tetraphenylporphyrin (TPP) using either a mortar and pestle or a ball mill. Grinding produces the cyclized product, porphyrinogen, which then needs to be oxidized. We currently use the traditional, "non-green" method for this step (organic oxidizer in chloroform), and have been able to successfully isolate TPP from our reaction mixture. However, we hope to find a more environmentally-friendly method of oxidation. Here we propose several possibilities that we will explore in the near future for developing a 100% green methodology for synthesis of these important organic molecules.

Supported by an award from Research Corporation for Science Advancement.

36. Biomass gasification.

Dwain Lyn-Sue (Department of Physical Sciences, Barry University, Miami Shores, FL)

This abstract serves as a review to introduce the process of biomass gasification alongside surveying the advantages and environmental benefits associated with it. In recent years the rising cost and environmental impact associated with petroleum based fuels has led to extensive research and developments in renewable fuel. One of the major developments that have been introduced thus far is the process of gasification. Gasification is the process of using low cost carbonaceous materials and converting them in oxygen deprived gasifier in order to produce a higher value, usable fuel bio-fuel. Since the process is carried out with controlled pyrolysis and partial oxidation, the carbon dioxide yield is significantly less and in return this yields substantial clean heat and charcoal as co-product. The strongly reducing atmosphere of the gasifier hinders the formation of SO_2 and NO compounds formation which are instead replaced by H_2S, NH_3 and N_2. In the later parts of the process, it is easier to remove these species than those that are produced as a result of oxidation. The hydrogen containing synthesis gas that is produced is what is later used for power. The advantages of gasification are many as it not only produces fuel from biomass which is highly abundant but also offers personal, societal and world benefits in various capacities.

37. Selected magnetically modified materials.

Matthew Traver (Department of Physical Sciences, Barry University, Miami Shores, FL)

Magnetic modification has become a focus of material sciences in recent years. The purposes of these materials range from analytical chemistry to security, generally analyzing their absorbent properties and ready magnetic manipulation. This review looks at recent magnetically modified carbon nanotubes (CNT), surfactants, and aerogels to demonstrate the varying methods and applications of magnetic modification. Carbon nanotubes were modified using ferromagnetic nanoparticles aggregated with the carbon nanotubes. Surfactants were modified by molecular bonding between iron (III) and a large cation connected to a long carbon chain. Cellulose aerogels were modified by growing magnetic cobalt ferrite $CoFe_2O_4$ nanoparticles on its surface in solution. All of these materials demonstrated gross attraction to magnetic fields. All materials were observed to maintain their original functionalities. Magnetic CNTs were still ready adsorbents as demonstrated by estrogen quantification, magnetic surfactants continued to decrease the surface tension of water, and the magnetic aerogel, while a bit heavier, maintained their flexibility and porosity. Given the retention of the magnetic materials respective properties, they could be used for quantitative analysis, environmentally friendly clean up, and lightweight electromagnetic insulation respectively.

Department of Psychology

38. Expanded retrieval and word learning: An optimal time schedule for word learning.

Karla A. Rivera-Torres[1], Haley A. Vlach [2], and Catherine M. Sandhofer[2] ([1]Department of Psychology, Barry University, Miami Shores, FL; [2]University of California, Los Angeles, Los Angeles, CA)

Word learning is an important component of children's cognitive development. Language development is central in communication, education, and culture. The process of word learning is quite difficult: perceiving an object, mapping a linguistic label to an object, binding this mapping to other instances, abstracting across instances, and generalizing to novel objects. Given the difficulty of the task, how is it then that children learn new words? Research has shown that several factors of the environmental context support word learning. One factor is the timing at which instances are presented to the learner. Previous

research has demonstrated that presenting learning instances in a spaced sequence results in more learning (Vlach, Sandhofer, & Kornell, 2008). Although, research has shown that timing matters, what is the optimal schedule for learning? One possibility is an expanding retrieval schedule. Research has revealed that retention for repeated items is better when repetitions are spaced out in variable-increasing intervals (Melton, 1970). This means that the probability of retaining information increases when it is learned multiple times using different spaced intervals. In this study, we examined which time schedule, massed, equally spaced, or expanding retrieval, is most optimal for word learning in three year-old children. We randomly assigned the children to the three time schedules using novel objects to learn novel words. We hypothesize that expanding retrieval will produce better long-term retention of words when the children are tested the following day.

Supported by NIH-NIGMS MARC Grant: 5T43 GM00821-27, Barry University & Graduate Division for Summer Research Programs (GDSPUR), University of California, Los Angeles (UCLA).

39. Bilingualism, time pressure, and the scholastic assessment test (SAT).

Karla A. Rivera-Torres and Michael DeDonno (Department of Psychology, Barry University, Miami Shores, FL).

The purpose of the present study was to explore the influence of time pressure and bilingualism on Scholastic Assessment Test (SAT) performance. Participants were randomly divided into two groups; a time limit group and a no time limit group. Both groups completed an SAT math and critical reading practice test. One group completed the tests under the specified time limit of 25 minutes as directed by the SAT developers. Another group completed the tests without any specified time limits taking an average of 30 minutes to complete each test. Bilingualism was quantified by self reported estimates of how long the second language had been practiced, how often the second language is used and self estimate of skill level in that language. Time pressure adversely influenced math but not critical reading performance. Bilingualism adversely influenced critical reading performance but not math performance. Time pressure had a stronger deleterious effect on bilinguals than monolinguals on both math and critical reading performance.

Supported by NIH-NIGMS MARC Grant: 5T43 GM00821-28, Barry University.

40. Depressive symptoms and sexual ambivalence in young adults.

Andrea Tirado[1], Julie Hill[2], and Julia Graber[2]([1]Department of Psychology, Barry University, Miami Shores, FL; [2]University of Florida, FL)

The current study explores sexual ambivalence as a predictive factor for depressive symptoms in young adults. While it is normal for adolescents to hold ambivalent feelings towards sexual intercourse (having both positive and negative feelings), continuing to be ambivalent as a young adult suggests that the process of identity development which takes place during adolescence has not been completed as suggested by Erikson's psychosocial development theory. Participants were 121 young adults who were currently attending a four-year university and ranged in age from 18 to 20. Participants were instructed to complete an anonymous online survey which included the Center for Epidemiological Study Depression scale (CES-D), 5 items measuring sexual ambivalence, and basic demographic questions. Results from the study suggest that young adults who were more ambivalent had higher odds of presenting symptoms of depression. The current study provides empirical evidence that ambivalence about sex continues during young adulthood and like identity development it is not resolved during adolescence.

Supported by UF-HHMI Science for Life, University of Florida.

BARRY UNIVERSITY - COLLEGE OF HEALTH SCIENCES

41. Modification of water bottles to decrease illness causing microorganisms in unpurified drinking water.

Chris Barnard, Geoffrey Kombich, Federico Lin, Chony Seng, Daniel Packert, Phil Gillis, and Stephen Dunham (College of Health Sciences, Barry University, Miami Shores, FL).

Waterborne illnesses are a major cause of death in areas without safe drinking water. In an effort to increase availability of safe drinking water in areas without water filtration systems, our research aims to modify water bottles using various modifications to enhance UV reflection thereby reducing illness-causing microorganisms in drinking water. The method used to modify the water bottles is presented here. Polyethylene terephthalate (or PET) water bottles were covered on one third of the exterior surface using aluminum foil, black electrical tape, and three different types of white paint each with and without barium sulfate. Preliminary ultraviolet (UV) light reflectivity for each surface was determined using an ILT1700 Research Radiometer UV meter. Water was collected from a surface water canal in South Florida in 5L carboy containers. A 100mL water sample was removed and tested for *E. coli* in the laboratory to establish a baseline of colonies present. The water was then poured into the 1L PET water bottles and placed in a grid on an open, unshaded area with the unpainted side of the bottle facing up towards the sunlight. All bottles were placed in direct sunlight between the hours of 11:00 AM and 4:00 PM. UV light exposure, sample temperature and ambient temperature was recorded every 15 minutes during the experiment. 100mL water samples were poured off and filtered for *E. coli* after 2.5 hours and 5 hours of sunlight exposure. Results presented include *E. coli* CFU baseline counts, *E. coli* CFU counts from 100mL samples obtained from modified and unmodified experiment PET bottles after 2.5 and 5 hours periods of sunlight exposure. Statistical differences between the baseline and experimental bottles was noted after 2.5 hour and 5 hour exposure times. No significant difference between the modified and unmodified PET bottles was noted.

Supported by DARPA grant HR0011-10-1-0064 to Barry University.

42. Titanium dioxide: photocatalysis and water purification.

Charles R. Lichtfield, Stephen Obeng, Rebecca Smidy, Andrew Lelchuk, Patricia Oliva, A. Amurio, Stephen Dunham, and Gerhild Packert (College of Health Sciences, Barry University, Miami Shores, FL).

Safe drinking water is central to human survival. However, there are many that still lack available safe drinking water. According to a study done by the World Health Organization nearly 2.6 billion people worldwide lack sanitized water. A simple method of using solar rays to purify drinking water was discovered in 1980s. Currently, this method can provide safe drinking water to rural populations that lack access to clean water. It effectively destroys bacteria and parasitic cysts and detoxifies organic pollutants through exposure to ultraviolet sunlight. Improvements on this method have been developed that make use of metals that act as photocatalysts. The method using titanium dioxide (TiO_2) effectively destroys bacteria and parasitic cysts while detoxifying organic pollutants when exposed to ultraviolet sunlight less time than the traditional method. TiO_2 is one of the main photocatalysts currently in use and was the focus of the first phase of our study, which examined the effect of depositing TiO_2 on brushes and placing them in bottles to detoxify surface water. In phase 2 of our study we added a binding agent to ensure that the TiO_2 more effectively bound to the brush. The use of photocatalytic TiO_2 will make water purification more cost-effective as a result of its fuel source--UV light–which is readily available and abundant. The use of this technology would lead to a substantial reduction in the use of toxic chemicals such as copper sulfate, and chloroisocyanurates which are currently needed to accomplish adequate water purification. For example, Miami Dade County has a daily purified water requirement of 333 million

gallons. Even with the addition of TiO_2, some aspects of traditional water processing including reverse osmosis and filtration would still remain.

Supported by DARPA grant HR0011-10-1-0064 to Barry University.

BARRY UNIVERSITY - SCHOOL OF ADULT AND CONTINUING EDUCATION

Department of Information Technology

43. An E-tutoring information system designed for continuing education in South Florida.

Renaud Augustin, Juan Avila, and Khaled Deeb (Department of Information Technology, School of Adults and Continuing Education, Barry University, Miami Shores, FL)

SouthFloridaTutors.org is a web based application designed to provide students with tutoring services in their vicinity. Currently, there are no online portal services where students can request assistance from tutors free of charge. Using a well-designed database and a very interactive and user friendly dynamic website, SouthFloridaTutors.org permits registered students to search for tutors in the South Florida area and from Palm Beach to Monroe. Students are provided with a various amount of tutoring information such as the tutor's distance from them, tutor's bio and the tutor's area of expertise in a very simple but yet informative format. As for registered tutors, they are given the ability to manage multiple students' profiles and attend to their requests at any given time through the Tutoring interface. The application also has an admin portal which features allow the administrator to see student's pending, completed, accepted or denied requests. The web based application also has in place various security requirements and restrictions to protect both the students and tutors personal information, such as a RCA 128-bit with MD5 encryption is use when registering, login in, and accessing student's and/ or tutor's portal. Additional feature currently on the works include:

- Tutors rating module
- Student feedbacks module
- Map and directions based on student and tutor addresses.
- Open Source web conferencing module (BigBlueButton.org)
- Tutor verification (questioner or credential submission).
- Private Live Chat

44. The power of holographic systems.

Andrew Hoo, and Khaled Deeb (Department of Information Technology, School of Adults and Continuing Education, Barry University, Miami Shores, FL)

The purpose of this research is to explain how holographic systems will be the next step in the evolution of the arts and in the development of education, movies, and graphics. Holographic technology will have a profound impact on our lives within the next decade. As an example, a TV commercial is constructed in a holographic movie about wolves attacking a wayward hunter in the snow. The movie appears so real that the customer feels that he is actually in the movie. Holograms are currently used to enhance the movie going experience in the form of 3-D imagery as seen in movies such as Avatar and Jaws. This

technology will take our movies to another level. it will help to improve current video game graphics and Computer-generated imagery (CGI) by allowing computer engineers to have a four-dimensional template to work from. In addition, the technology could be used in schools as a way to enhance learning. For example, it could serve as an upgrade to current Live Meeting formats. Lastly, it could help solve America's obesity problem on levels the Nintendo Wii has never reached. With all technological advancements, there are consequences. This may include issues with moral uses, decrease in interpersonal skills, replacement of jobs, and become a very high electricity consumer. However, holographic technology will be an invaluable resource and will profoundly change our world as we know it. Our imaginations will finally become projections of light.

BARRY UNIVERSITY: ROADS (RESEARCH OPPORTUNITIES AND DIRECTIONS IN SCIENCE) RESEARCH CLUB

45. A survey of normal gut microbial flora in harvestmen (Order Opiliones, Class Arachnida).

Jenycce Montanez, Jason Llaneras, Terry Thomas, DeLorean Ruffin, Gisselle Vega, Elnara Muradova, Akmad Akhmedov, Robert Combs, Daniela Mendoza, Precious Ezeamama, Cyndie Derne, Erline Dolce, Daphne Petit-Homme, and Brenda Schoffstall (Department of Biology, Barry University, Miami Shores, FL)

The spider-like arthropods known as the "harvestmen," or more commonly "daddy long-legs" (Order Opiliones, Class Archnida) are familiar though rarely-studied animals. Fossil records of harvestmen indicate they have been in existence for over 300 million years. Although closely related to the true arachnid spiders (Order Araneae), harvestmen neither produce venom nor liquefy prey to ingest enzymatically pre-digested food as true spiders do. Rather, harvestmen are small-bodied predators and scavengers that masticate solid food, suggesting the necessity of a somewhat more complex digestive physiology than that of the true spiders. The normal gut bacterial flora of Order Opiliones has never been classified; we hypothesize that the normal digestive flora found in harvestmen will be more diverse than that found in true spiders. To investigate this hypothesis, we have begun a survey of aerobic bacterial isolates from the gut and feces samples of two harvestmen species, *Leiobunum* sp. and *Vonones ornata*. We compared aerobic, non-fastidious isolates from these harvestmen to those from a common and representative true spider, *Gasteracantha cancriformes* (the spiny-backed orbweaver). From *V. ornata*, we have identified gram negative *Pseudomonas* spp., *Escherichia coli*, and *Klebsiella* spp., and Gram positive *Staphylococcus* spp. From *Leiobunum*, we have identified Gram negative *Escherichia coli*, *Enterobacter* spp., and *Salmonella enterica*, and gram positive *Streptococcus* spp., *Staphylococcus* spp. and *Bacillus subtilis*. In contrast, cultures from *G. cancriformes* have thus far only yielded identification of Gram positive *Bacillus* spp. and *Lactobacillus* spp. From this preliminary survey of aerobic bacteria, we suggest the normal gut microbial flora of harvestmen exhibit greater diversity than those of true spiders. These findings will serve to further our understanding of the complex digestive system in this ancient lineage of arachnids.

Supported by NIH-NIGMS MARC: T34 GM008021 and NIH-NIGMS MBRS RISE: R25 GM059244 awards, Barry University.

ST. THOMAS UNIVERSITY

School of Science, Technology, and Engineering Management

46. Characterization of putative stem and neural progenitor cell populations in adult zebrafish brainstem tissue.

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Although post-embryonic neurogenesis is limited in the mammalian brain, zebrafish (*Danio rerio*) retain multiple proliferative neurogenic and stem cell niches throughout adult life. The focus of our research is to study how injury to the central nervous system (CNS) affects the induction of neurogenic progenitor cell fates in the adult zebrafish brain. It has been well documented that in contrast to mammals, adult zebrafish recover functionally from a complete spinal cord transection injury. Damaged axons deriving from neurons within brainstem motor nuclei are able to regenerate across and beyond a spinal cord transection site. This ability is not characteristic for all brainstem neurons; different descending populations exhibit distinct regenerative responses, including failure to regenerate beyond the lesion site. We hypothesize that spinal cord injury will induce an endogenous, quiescent population of brainstem progenitor cells that act to integrate and enable the regenerative response seen following spinal cord injury in the fish. We are currently examining regenerative brainstem regions for stem cell marker expression pre- and post-injury. Prior to injury, Nestin and Sox 2 immunoreactivity were observed near ventricular areas, as well as in ventral brainstem regions, which contain nuclei from descending cerebrospinal projection neurons. These markers were also detected in similar brainstem regions following focal brainstem injury, as well as spinal cord injury. In addition, we have established an adult brainstem cell culture system to study *in vitro* axonal outgrowth mechanisms in relation to permissive and non-permissive conditions. Our heterotypic cultures contain a subpopulation of nestin positive cells. Using double and triple labeling with antibodies against Proliferating cell nuclear antigen (PCNA), Human neuronal protein C (HuC), and tubulin we further characterized this putative stem/progenitor cellular population. Currently, we are analyzing how these putative stem cells respond to non-permissive growth conditions and affect the growth response of neighboring cells.

Supported by U.S. Dept. of Defense W81XWH-11-1-0645 to JAP.

47. Primary neuronal brainstem culture from adult zebrafish: interactions with an inhibitory chondroitin sulfate proteoglycan-rich environment.

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Chondroitin sulfate proteoglycans (CSPGs) inhibit axonal regeneration from brainstem neurons in the injured mammalian spinal cord. In zebrafish, axons from brainstem neurons regenerate beyond a spinal cord injury site despite the presence of CSPGs. This ability is not characteristic of all brainstem neurons; different neuronal populations exhibit distinct responses, including failure to regenerate beyond the lesion site. To investigate the axonal growth response of zebrafish brainstem neurons to CSPGs, we developed a novel, primary neuronal culture system derived from the brainstem of adult zebrafish. We hypothesized

that our culture would contain different neuronal populations that would respond distinctively to CSPGs *in vitro*. Our results support this hypothesis revealing four different populations of brainstem neurons: (1) neurons repelled by CSPGs, (2) neurons that extend processes into CSPG areas, (3) neurons that grow axons exclusively on CSPGs, and (4) neurons that grow on CSPGs but extend processes out of the inhibitory environment. Our data suggest that the ability to grow across CSPGs is intrinsic to the neuron. We have molecularly characterized our heterotypic brainstem cultures using immunocytochemistry and found neuronal, glial, and putative stem/progenitor cell populations. We are currently analyzing how different cell populations respond to CSPGs. Finally, we are examining how growth-inhibiting CSPGs and the axonal growth-promoting zebrafish neuronal adhesion molecule L1.1 (nadl1.1) interact to regulate axon outgrowth *in vitro*.

Supported by U.S. Dept. of Defense W81XWH-11-1-0645 to JAP.

48. Neurocan expression in the CNS of adult zebrafish and its effect on axonal growth of brainstem-derived primary cultures.

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It has been established in amphibians and fish that neurons can successfully regenerate their axons in the damaged central nervous system (CNS). This regenerative ability contrasts with that observed in mammals, whose neurons fail to regenerate their axon after CNS injury. Regeneration failure in the mammalian CNS is due in part to the presence of axon growth-inhibitory molecules within and near the site of damage. These inhibitors ultimately prevent the formation of axon circuits that could be involved in or recruited for motor functions thereby facilitating functional restoration. We have previously demonstrated that chondroitin sulfate proteoglycans (CSPGs), a family of axon growth-inhibitory molecules are present following CNS injury in adult zebrafish. We then investigated whether a CSPG family member neurocan, which has been shown to play a role in the prevention of CNS regeneration in mammals, is found within injured adult zebrafish CNS. Using reverse transcription-polymerase chain reaction (RT-PCR), we now qualitatively demonstrate that neurocan is expressed in the CNS pre- and post-injury. We are currently examining neurocan protein expression utilizing Western blot analysis and immunohistochemistry pre- and post-injury. In addition, we have cloned a Myc-tagged full length zebrafish neurocan b construct. We are presently isolating and characterizing the protein for future use in our adult zebrafish brainstem culture system. We hypothesize that zebrafish neurocan b is a growth-inhibitory molecule. Taken together, the overall objective of this project is to understand the molecular mechanisms underlying the CSPG interactions of the regenerative neurons.

Supported by U.S. Dept. of Defense W81XWH-11-1-0645 to JAP.

49. Zebrafish: an *in vivo* model for CNS axonal regeneration after injury.

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In contrast to mammals, adult zebrafish (*Danio rerio*) recover functionally from a complete spinal cord injury. It has been well documented that chondrotin sulfate proteoglycans (CSPGs), a family of axon growth inhibitory molecules, contribute to the lack of functional restoration in the injured mammalian spinal cord. We recently demonstrated that CSPGs are present following CNS injury in adult zebrafish. Data from reverse transcription-polymerase chain reaction (RT-PCR) experiments show that the CSPG family member neurocan and its putative receptor, receptor-type protein tyrosine phosphatase sigma a (ptprsa), are expressed in the CNS pre- and post-injury. Previous work has also demonstrated that brainstem neurons in the adult zebrafish can regenerate their axon beyond a spinal cord lesion despite the presence of these inhibitory molecules. This ability is not characteristic for all brainstem neurons; different populations exhibit distinct regenerative responses, including failure to regenerate beyond the lesion site. We are currently utilizing our *in vivo* model to identify specific genes involved in the CNS regeneration response and to determine how axonal regeneration occurs despite the presence of CSPGs. We have established an *in vivo* tracing protocol that permits identification of descending brainstem cells capable of regeneration following CNS insult. This technique allows isolation of individual cells and comparison of genes between regenerating and non-regenerating cell populations. We aim to understand the molecular mechanisms underlying the CSPG interactions of regenerative neurons. These data may serve as a foundation for the development of tailored strategies to promote axon regeneration across injury sites in the mammalian spinal cord.

Supported by U.S. Dept. of Defense W81XWH-11-1-0645 to JAP.

50. Receptor-type protein tyrosine phosphatase sigma a (ptprsa) expression in the central nervous system of adult zebrafish and brainstem-derived primary neuron cultures.

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In the mammalian central nervous system (CNS), the transmembrane protein tyrosine phosphatase PTPsigma was recently identified as a receptor neurocan, a chondroitin sulfate proteoglycan (CSPG) which inhibits axon regeneration following an injury. The goal of our project is to elucidate the role of PTPsigma in zebrafish axon regeneration following spinal cord injury (SCI). Unlike mammals, in adult zebrafish damaged axons regenerate across and beyond a SCI site. We hypothesize that the zebrafish homolog of PTPsigma, Protein tyrosine phosphatase sigma a (Ptprsa), like its mammalian counterpart, is a receptor for CSPGs. Furthermore, we suspect that axon regeneration in the zebrafish CNS is due in part to reduced PTPsigma activity following injury. To investigate *ptprsa* expression following CNS injury in the zebrafish, we are currently using Reverse Transcriptase Polymerase Chain Reactions (RT-PCR). We observed *ptprsa* mRNA expression in uninjured brain and spinal cord tissue, as well as in injured brain tissues. We are also investigating possible Ptprsa interactions with CSPGs *in vitro* through the evaluation of *ptprsa* expression and morpholino knockdown in adult zebrafish brainstem-derived primary neuron cultures. We have detected *ptprsa* mRNA expression in brainstem neuron cultures grown on a growth-permissive laminin substrate, as well as on a CSPG-containing/laminin substrate. Taken together our qualitative RT-PCR data suggest that *ptprsa* gene transcription may not be governed by injury (*in-vivo)* or substrate (*in-vitro)*.

Supported by U.S. Dept. of Defense W81XWH-11-1-0645 to JAP.

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Program Notes