

Education is the movement
from darkness to light.
Allan Bloom

Friday, March 13, 2015
Nunemaker Auditorium
9:30 am – 5:00 pm

25th Annual

UNDERGRADUATE RESEARCH
SYMPOSIUM

BIOLOGICAL SCIENCES DEPARTMENT



LOYOLA
UNIVERSITY
NEW ORLEANS

WELCOME TO THE TWENTY-FIFTH ANNUAL UNDERGRADUATE RESEARCH SYMPOSIUM!

Today we celebrate 25 years of outstanding undergraduate research at Loyola University New Orleans. The students who will present their projects have enhanced their undergraduate experiences by taking on directed research and creative activity under the supervision and mentorship of some of Loyola's most distinguished faculty. Open only to graduating seniors, students pursuing honors in Biology perform collaborative research with a professor and present their research projects at this symposium.

If you're attending this event as a student, we hope you'll be inspired to develop your own research or creative projects. We invite you to visit our website at <http://www.loyno.edu/biology> to learn about the many ways undergraduates can get involved with research here at Loyola. For more information about contributing to the undergraduate research experience through our Rev. John H. Mullahy Endowed Fund, please contact Karen E. Anklam, Major Gifts Officer, Development/Capital Campaigns Department at (504) 861-5423 or keaklam@loyno.edu.

SPECIAL THANKS

We would like to offer our special thanks to the following for their continued support of this event and our wonderful students. Without you it would not be possible.

Mullahy Fund Donors

Mrs. Irene T. Hofstetter

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Dr. Frank Jordan, Chair
Department of Biological Sciences



Dr. Patricia Dorn,
Symposium Coordinator 2015

25th Annual Biological Sciences Undergraduate Research Symposium

Presentation Schedule

- 9:30 *Coffee & Refreshments*
- 10:00 **Dr. Frank Jordan, Chair** Introductory Remarks
- 10:15 **Jackeline Araujo** Regulation of Gene Expression by NR4A2 in Osteoarthritis.
ADVISOR: Dr. Kimberly Mix
- 10:30 **Caroline Stallard** Morphological, Physiological, and Environmental Variability in Nine *Phragmites australis* Populations in the Mississippi River Delta.
ADVISOR: Dr. David White
- 10:45 **Isabelle Bottger** Influence of Ambient Solar UV on the Growth and Morphology of Plants Differing in Diurnal UV Sunscreen Protection.
ADVISOR: Dr. Paul Barnes
- 11:00 *Coffee Break*
- 11:15 **Talita Antunes Maia** Acclimation to UV Radiation in Genotypes of *Arabidopsis thaliana* Differing in UV Photoreceptor Composition.
ADVISOR: Dr. Paul Barnes
- 11:30 **Taylor Burns** Body-trait Mediated Movements of Fish Across Fragmented Landscapes.
ADVISOR: Dr. Frank Jordan
- 11:45 **Mallory Hirschler** Effect of Sampling Duration on Estimation of Abundance of Blue Crab Larvae.
ADVISOR: Dr. Frank Jordan
- 12:00 *Lunch Break*
- 1:00 *Welcome – Afternoon Session*

25th Annual Biological Sciences Undergraduate Research Symposium

Presentation Schedule continued

NOTES

| | | |
|------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1:15 | Andrea A. Dantin | Echocardiography Research of Rheumatic Heart Disease <i>ADVISOR:</i> Dr. Andrea Beaton, M.D. Children's National Hospital <i>SPONSOR:</i> Dr. Elizabeth Beard |
| 1:30 | Yunuen Cacique Borja | Role of CD45RO Signaling in Modulation of HIV Infection. <i>ADVISOR:</i> Dr. Seth Pincus, M.D. <i>SPONSOR:</i> Dr. Elizabeth Beard |
| 1:45 | Daniel Francis | Using Immunohistochemistry to Assess Joint Functionality. <i>ADVISOR:</i> Dr. Rosalie Anderson |
| 2:00 | Luiza Nascimento | Analysis of the Regenerated Joint: Muscles, Tendons, and Ligaments. <i>ADVISOR:</i> Dr. Rosalie Anderson |
| 2:12 | Harley Augustine | Is Msx1 Expression a Prerequisite for Regeneration? <i>ADVISOR:</i> Dr. Rosalie Anderson |
| 2:24 | <i>Coffee Break</i> | |
| 2:39 | Troy Thayer | Characterizing Bone Morphogenetic Protein Signaling during Joint Development and Regeneration. <i>ADVISOR:</i> Dr. Rosalie Anderson |
| 2:51 | Kevin Kim | Characterizing Fibroblast Growth Factor Expression during Regeneration and Failed Regeneration. <i>ADVISOR:</i> Dr. Rosalie Anderson |

Blenda Dias Sousa**4:35 pm**

Advisor: Dr. Patricia Dorn

What is the Prevalence of *Trypanosoma cruzi*, the Chagas Disease Parasite, in Pack Rats (*Neotoma fuscipes*) in Arizona?

Trypanosoma cruzi is the causative agent of Chagas disease and an increasing concern in the United States. Although human cases in the U.S. are quite rare, *T. cruzi* is frequently detected in many wild mammals, especially in armadillos, opossums, raccoons, and rodents. Previous studies showed that raccoons and opossums are the most common wild reservoirs in the eastern U.S. and that woodrats are the most common reservoir in western U.S. These mammals have an important role in maintaining the parasite in nature. Woodrats, also called a packrats, occur across wide geographic and ecological ranges: from the deserts of the western U.S. to the forests of the east coast. A packrat can be any of the species of the rodent genus *Neotoma*. In this study, we worked with Arizona packrats (*Neotoma fuscipes*). There are only two, quite old studies about the *T. cruzi* prevalence in packrats in Arizona, and these used older, less sensitive techniques. The goal of our study is to determine the current infection prevalence in packrats in Arizona. We isolated DNA from the hearts of donated, frozen packrat carcasses. We amplified *T. cruzi* DNA using the polymerase chain reaction (PCR) and agarose gel electrophoresis to see if the packrats were infected. The prevalence of *T. cruzi* in these packrats will be discussed.

25th Annual Biological Sciences Undergraduate Research Symposium**Presentation Schedule continued**

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|------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3:03 | Michelle Huezo | Developmental Changes in the Limb and the Loss of Regenerative Potential. <i>ADVISOR:</i> Dr. Rosalie Anderson |
| 3:15 | Brooke Bullock | Insect Pollinators in Urban Parks and Community Gardens. <i>ADVISOR:</i> Dr. Aimée Thomas |
| 3:30 | <i>Coffee Break</i> | |
| 3:45 | Courtney Slugher | Insect Pollinators in Urban Parks and Community Gardens. <i>ADVISOR:</i> Dr. James Wee |
| 4:00 | Meghan Gallaspy/ Annie McClure | Chagas Parasite Strains Present in Kissing Bugs from Mexico to Ecuador. <i>ADVISOR:</i> Dr. Patricia Dorn |
| 4:20 | Rafaela Pessoa | Is <i>Triatoma dimidiata</i> a Species Complex? Clarifying Phylogenetic Relationships using a Mitochondrial Gene. <i>ADVISOR:</i> Dr. Patricia Dorn |
| 4:35 | Blenda Dias Sousa | What is the Prevalence of <i>Trypanosoma cruzi</i> , the Chagas Disease Parasite, in Pack Rats (<i>Neotoma fuscipes</i>) in Arizona? <i>ADVISOR:</i> Dr. Patricia Dorn |
| 5:00 | <i>Crawfish Social – Peace Quad</i> | |

Jackeline Araujo**10:15 am**

Advisor: Dr. Kimberly Mix

Regulation of Gene Expression by NR4A2 in Osteoarthritis.

Osteoarthritis (OA) is the leading cause of disability in the U.S., affecting over 27 million adults. Currently there is no cure, and existing treatments merely slow disease progression. The transcription factor NR4A2 may serve as a new drug target since it is over-expressed in arthritic joints and regulates inflammation and cartilage degradation. NR4A2 seems to have opposing functions in chondrocytes and synoviocytes, leading us to hypothesize that NR4A2 may differentially regulate gene expression in these important cell types. To test this, primary synoviocytes and chondrocytes were obtained from a 56 year-old male OA patient. NR4A2 was over-expressed by lentiviral transduction, RNA was harvest from the cells, and gene expression changes were measured using qPCR arrays specific for 88 genes involved in arthritis. RT-qPCR confirmed potent over-expression of NR4A2 mRNA in synoviocytes (5-fold) and chondrocytes (139-fold). Normalized gene expression results from the qPCR arrays demonstrated that NR4A2 is not a global regulator of transcription as it specifically induced a subset of eight genes and repressed an additional two genes in both cell types. NR4A2 also differentially regulated four genes in synoviocytes and chondrocytes, suggesting that NR4A2 may control select gene expression pathways in a cell type specific manner. From these results, we have identified a set of putative NR4A2 target genes and documented differential patterns of gene expression in synoviocytes and chondrocytes. Future studies will be aimed at validating these target genes in cells from additional OA patients and understanding the functions of these genes in OA.

Rafaela Pessoa**4:20 pm**

Advisor: Dr. Patricia Dorn

Is *Triatoma dimidiata* a Species Complex? Clarifying Phylogenetic Relationships using a Mitochondrial Gene.

Chagas disease, or American trypanosomiasis is a disease caused by the parasite *Trypanosoma cruzi*. Chagas causes the greatest negative economic impact of any parasitic disease in the Americas. Triatomine insect vectors are responsible for the vast majority of transmission, so vector control is the best way to decrease transmission. In South America, pesticide application was effective in areas with predominantly domestic vectors. However, in Central America control is challenging because the main vector, *Triatoma dimidiata*, is very diverse across its large geographic range. For example, it can be found in domestic, peridomestic and sylvan habitats and following spraying, peridomestic and sylvan bugs reinvade houses. Results of previous studies suggest that *T. dimidiata* may be a species complex perhaps including two cryptic species, which can, at least partially, explain the control challenges. Previous work in our lab and others, inferring phylogeny using the mitochondrial *cytochrome b* gene (mt *cyt b*) and the nuclear internal transcribed spacer 2 (ITS-2) DNA, divide *T. dimidiata* into three clades. Indeed, these two genes support two of these clades as cryptic species. To test if these really are cryptic species we are sequencing additional genes. We report that phylogenetic inference using the mitochondrial gene cytochrome oxidase I (CO I) also supports the cryptic species. These findings are very important to design effective control strategies against the taxa most responsible for human disease.

**Annie McClure &
Meghan Gallaspy**

Advisor: Dr. Patricia Dorn

4:00 pm

Chagas Parasite Strains Present in Kissing Bugs from Mexico to Ecuador.

Approximately 7-8 million people are infected with *Trypanosoma cruzi*, the causative agent of Chagas disease. Although Chagas disease has been detected in the U.S., its greatest prevalence is in Latin America, where it is a leading cause of heart disease and is responsible for about 20,000 deaths annually. The *T. cruzi* parasite is spread primarily through the feces of triatomine bugs called kissing bugs. Kissing bugs feed on a variety of animals and infect them with the parasite. Recent studies divide *T. cruzi* into six strains, *T. cruzi* I-VI (TcI-VI). It is essential to understand which strains are present because different strains of the parasite may be responsible for various disease manifestations and may circulate in different transmission cycles. Specifically, some strains of the parasite are found in human transmission cycles, whereas others are only found in animals. *T. dimidiata* is the most important kissing bug species in Central America. Very little is known about the *T. cruzi* strains circulating in this species. From previous studies in the lab *T. cruzi*-infected *T. dimidiata* were available. We determined the *T. cruzi* strains present in these *T. dimidiata* specimens. The two strains, TcI and Tc IV, were identified in *T. dimidiata* across its geographic range. This provides information about what strains of the parasite are circulating in Central America and will help target control efforts against Chagas Disease.

Caroline Stallard

Advisor: Dr. David White

10:30 am

**Morphological, Physiological, and Environmental Variability in
Nine *Phragmites australis* Populations in the Mississippi River Delta.**

The cosmopolitan and highly invasive common reed, *Phragmites australis*, has multiple haplotypic lineages distinguished by chloroplast and microsatellite DNA. Its occurrence in the Mississippi River Delta has increased dramatically in recent years. Past studies have identified three main lineages present in the region: Eurasian or Short form, Gulf Coast form, and a Delta form. I studied nine local populations of these forms, which exhibited readily observable morphological differences in culms, leaves, and inflorescences. I analyzed this variation using state-of-the-art statistical ordination techniques that showed haplotypic patterns in morphology and physiology. Physiological parameters indicating productivity, and thus environmental health, also vary by haplotype, grouping in ordinations based upon rates of photosynthesis, transpiration, and conductance. I collected temperature, salinity, and water level data in the feeder passes adjacent to the nine reed populations and determined that the Delta's water environment is more variable than expected at a number of temporal and spatial scales. This variable environment must impact the common reed's physiology, as shown by variation within haplotypes according to site. This study reveals patterns of haplotypic variation and site-specific differences that indicate interplay between genes and environment. Future studies should address the logistical difficulties of data collection in such a dynamic environment in order to better delineate the relationship between water quality and *Phragmites'* varying phenotypic expressions of morphology and physiology. This and other studies will help to distinguish between native and introduced *Phragmites* lineages, which can improve wetlands management efforts both in the region and around the world.

Isabelle "Issy" Bottger**10:45 am**

Advisor: Dr. Paul Barnes

Influence of Ambient Solar UV on the Growth and Morphology of Plants Differing in Diurnal UV Sunscreen Protection.

Plants have different ways of acclimating and protecting themselves from UV light. Some plants, like Peppers (*Capsicum annuum*), use sun protectant 24 hours a day. Okra (*Abelmoschus esculentus*) is diurnally protected; meaning, it "shuts off" the protection at night. It was therefore asked, if these plants have differentiating systems of avoiding UV, will they have differing morphological and physiological qualities when grown in the absence of it? Both species were grown under three UV filter treatments outdoors: Llumar (inhibiting all UV), Mylar (inhibiting UVB, transmitting UVA), and Aclar (transmitting all UV). The data, which included the dry mass of stems and leaves, area of leaves, height of stems and internodes, and UV leaf transmittance, were collected over the course of 2 months. UV affected the morphology of peppers more than that of okra. However, the UV transmittance of the three treatments of okra plants were statistically different ($P < .0001$). These results suggest that growth and morphological sensitivity to solar UV is related to the degree of flexibility in UV sunscreen protection.

Courtney Slugher**3:45 pm**

Advisor: Dr. James Wee

The Audubon Park Lagoon NanoSafari: Investigating an iPad App as a Learning Tool to Link Microscopic Organisms and People Visually.

Although most people have a basic appreciation of microorganisms as pathogens, we do not understand the critical roles microbes play in the Earth's natural systems because we cannot see them. Thus, the objective was to develop an iPad app to enhance conceptual understanding of aquatic microbes by connecting learners in a natural setting to specific aspects of microbial biodiversity and ecological roles. Learners participated in a "NanoSafari" nature walk with an iPad containing images and other information about the photosynthetic microbiota from the Audubon Park Lagoon (APL).

Images via photomicrography and other information on the APL's algal flora were obtained during biweekly sampling from January – June 2014. Subsequently, the Audubon Park Lagoon NanoSafari menu line was developed in the "GO to Lake Thoreau" iPad application. The opening screen in the NanoSafari nature walk addresses three questions, "Where is the Audubon Park Lagoon?", "What is a NanoSafari?" and "What are algae?". Next, participants explore three theme-based stations during the NanoSafari, "Algal Diversity", "Algal Communities" and "Ecological Interactions". The effectiveness of the NanoSafari as a learning tool was tested in the Biology of Organisms laboratory course using 10 objective, content questions with three sections and one control section that did not experience the NanoSafari. There was no difference in the pre-assessment scores between the control and NanoSafari groups. The pre- versus post-assessment scores increased for both groups. However, the NanoSafari group scores increased significantly compared to the control group scores ($p \leq 0.05$).

Brooke Bullock**3:15 pm**

Advisors: Dr. Aimée Thomas & Dr. Eric Hardy

Insect Pollinators in Urban Parks and Community Gardens.

Insect pollination is a vital ecosystem service responsible for close to 90% of food production for human consumption. A growing body of research indicates certain insect pollinator populations are in severe decline, some of the most well-known being the Monarch butterfly (*Danaus plexippus*) and European honey bee (*Apis mellifera*). These declines, along with many other insect species, are linked to an increase in pesticide use, habitat loss and fragmentation, invasive species, and pollution. These factors are all highly associated with urbanization which is why the necessity for places of refuge in urban parks and gardens is so crucial to insect pollinator conservation. The expanse of urban areas often results in the alteration of the composition and distribution of a variety of insect species and typically leads to a decline in native invertebrate species. Building pollinator friendly parks and gardens in urban areas, however, has been found to stabilize and even increase urban insect pollinator populations. This research addresses whether some of the urban parks and community gardens in the New Orleans area harbor a diverse community of insect pollinators. The data collected can serve as an indicator for what characteristics of urban parks or gardens were beneficial to insect pollinators. A primary focus was placed upon plant species as insect attractants. A survey was conducted in Audubon Park, Crescent Park, and The Urban Farmstead during the summer and fall 2014 to assess insect species richness and abundance in these urban areas. This research will serve as a baseline for future studies on insect pollinators in urban environments in New Orleans.

Talita Antunes Maia**11:15 am**

Advisor: Dr. Paul Barnes

Acclimation to UV Radiation in Genotypes of *Arabidopsis thaliana* Differing in UV Photoreceptor Composition.

Epidermal UV shielding was measured in growth chamber grown *Arabidopsis thaliana* that was transferred to five different light environments (growth chamber, greenhouse, outdoor shade, outdoor no UV, and outdoor full UV) to evaluate UV acclimation potentials. UV shielding increased from 40.6 to 95.2%, 41.4 to 97.5% and 60.8 to 95.5% in the outdoor+UV, outdoor-UV and outdoor+shade treatments, respectively. In the Chamber and Greenhouse treatments, where plants were not exposed to UV radiation, UV shielding showed no appreciable change (96.1 to 97.9% and 94.4 to 97.5%, respectively). These results suggest that mature leaves of *Arabidopsis* can acclimate to new UV regimes but these responses appear to require some exposure to UV radiation.

Taylor Burns**11:30 am**

Advisor: Dr. Frank Jordan

Body-trait Mediated Movements of Fish Across Fragmented Landscapes.

Habitat loss and fragmentation is one of the primary drivers of the ongoing global decline in biological diversity. In order to help address this problem, conservation biologists are working to better understand and predict which species are most susceptible to habitat loss and, more specifically, which biological traits contribute to this susceptibility. Shallow marine landscapes are often dominated by expansive seagrass habitats that support diverse communities of fishes. Increasing fragmentation of these seagrass habitats is contributing to significant declines in abundance of many of these fishes, including some species that support commercial and recreational fisheries. The goal of my research was to identify relationships between body traits of small fishes and their movements in fragmented seagrass habitats in the Outer Banks of North Carolina. To do so, I used video and still photographs to quantify movement behavior of fishes with different body traits in response to varying amounts of seagrass cover and risk of predation in a laboratory mesocosm. I found that cryptic, benthic, and sedentary, fishes such as blennies and toadfish are much less likely to move across fragmented habitats than are silvery, pelagic, and active fishes such as pigfish and pinfish. I also found that silvery, pelagic, and active fishes were more likely to modify their movement between patches. This preliminary research will be used to guide future studies of the effects of seagrass fragmentation on fishes.

Michelle Huevo**3:03 pm**

Advisor: Dr. Rosalie Anderson

Developmental Changes in the Limb and the Loss of Regenerative Potential.

Joints play important roles in our body; in particular, they allow movement and provide mechanical support. Joint trauma, congenital defects, and disease are debilitating to billions of people. For this reason, a model to study joint regeneration would allow us to better design approaches for improving the condition and quality of joints in humans. We have developed a joint regeneration model utilizing the embryonic chicken. This model is advantageous in that regeneration of the elbow joint occurs at an early stage of development, but this ability is lost at a later stage. This research focuses on understanding the natural barriers that may arise between a regeneration-competent stage and a regeneration-incompetent stage. By understanding what the barriers are and what causes them to arise, we can develop strategies to help overcome them. The barriers may exist at the cellular and/or molecular levels; so with the aid of staining procedures, immunohistochemistry, and *in situ* hybridization knowledge on what the barriers are can be obtained. Being able to know how to overcome the challenges involved with regenerating a joint can help us improve the joint regeneration model and ultimately, develop therapies for regenerative repair in humans.

Kevin Kim**2:51 pm**

Advisor: Dr. Rosalie Anderson

Characterizing Fibroblast Growth Factor Expression during Regeneration and Failed Regeneration.

Members of the heparin-binding Fibroblast Growth Factor (FGF) family have been shown to play many roles in various developmental processes, such as angiogenesis, cell proliferation, differentiation, and migration. In addition, FGFs are implicated in the initiation of regeneration in amputated zebrafish fins and amphibian limbs. Furthermore, treatment of amputated limb buds of chick embryos with FGF-soaked beads results in a successful regeneration response. By using the chicken embryo as the animal model, this research attempts to examine the roles of FGF8, FGF9, FGF10, FGF16, FGF18, and FGF19 during regeneration of the elbow joint. Gene expression patterns of FGFs at several time points, obtained via *in situ* hybridization, are observed in normal, developing chick embryos, in regeneration-competent chick embryos, and in regeneration-incompetent chick embryos. Possible roles that FGFs may perform are suggested based on those observations. Finally, successful regeneration in a nonregenerating model is attempted by applying FGF beads to the joint excision site. The importance of FGFs in joint regeneration of the chick embryo is investigated, and this may potentially contribute to the design of new therapeutic options for joint loss or degenerative joint diseases.

Mallory Hirschler**11:45 am**

Advisor: Dr. Frank Jordan

Effect of Sampling Duration on Estimation of Abundance of Blue Crab Larvae.

Blue crabs, *Callinectes sapidus*, are a dominant benthic invertebrate and an important commercial fishery resource in the Gulf of Mexico. Local fishermen have expressed concern about declining abundance of blue crabs in the Lake Pontchartrain estuary and attributed these declines to reduced recruitment of larvae due to construction of the Inner Harbor Navigation Canal Lake Borgne Surge Barrier and the BP Deepwater Horizon oil spill. Unfortunately, there is little data available to evaluate these concerns because of the high costs associated with sampling blue crab larvae. The costs are high because the passive settlement substrates developed to standardize the sampling process were designed to be retrieved every 24 hours. We conducted the current study to determine if these samplers could be deployed for up to a week at a time and thus reduce the financial and logistical resources needed to quantify recruitment. During the summer of 2014, we deployed a total of 17 groups of 4-8 samplers in three different Louisiana coastal estuaries. Samplers were deployed from one to seven days and then retrieved so that we could identify and enumerate blue crab larvae. Our results will be used to test the hypothesis that samplers deployed for longer periods of time will generate similar estimates of abundance per day as samplers deployed for shorter periods.

Andréa A. Dantin**1:15 pm****Advisor:** Dr. Andrea Beaton,
Children's National Hospital**Sponsor:** Dr. Elizabeth Beard**Echocardiography Research of Rheumatic Heart Disease.**

Rheumatic heart disease (RHD) affects about 70 million people worldwide and has an annual death rate of 1.4 million. Africa has the most children with this disease; it is estimated that in sub-Saharan Africa, more than a million children are suffering from this condition. In Uganda, RHD is the most common cause of heart disease in patients between ages 15 and 49. If RHD is not diagnosed early, it can result in heart failure and premature death. With many rural communities around Uganda, it is important to find a sustainable way to early diagnose RHD. Our research, lead by Children's National Hospital, worked to develop a set of criteria in order for local nurses to discover through ultrasound, both mitral and aortic regurgitation, two early signs of RHD. Our hope was that the screening criteria we set would result in identifying that the nurses were able to pre-screen children without overlooking essential cases. We worked closely with the schooling system so that many children from surrounding local villages were screened and then managed.

A second study we undertook was a look at the quality of life of the children and their families that we were screening. A recent study suggests that screening for RHD negatively impacts the quality of life of the children and their families that are screened. Our study was to evaluate whether this effect was true in the echocardiographic screening program in Uganda.

Troy Nathan Thayer**2:39 pm****Advisor:** Dr. Rosalie Anderson**Characterizing Bone Morphogenetic Protein Signaling during Joint Development and Regeneration.**

Repair or regeneration of damaged tissues through stimulation of endogenous regenerative capabilities is the premise of regenerative medicine. Being able to uncover factors or conditions that would allow for a regenerative response is assisted by having a model that would allow one to study the regenerative response. We have developed a model of joint regeneration utilizing the chicken embryo. The use of the chicken embryo not only allows for easy accessibility, it has the added advantage of displaying an early stage joint regenerative response and a late stage non-regenerative response. Previous research shows that Bone Morphogenetic Protein (BMP) is a candidate molecule for an important regeneration factor. BMPs are required for skeletal development and the maintenance of bone homeostasis. Furthermore, BMPs have been shown to play an important role in mammalian digit tip regeneration, and Noggin, a BMP antagonist, inhibits regeneration. This research examines the effect of *BMP* signaling on joint development and regeneration. The early stage regeneration model and control limbs are used to determine if BMP is involved in the regeneration response and where *BMPs* are expressed during normal joint development, respectively. BMP beads are applied to the early stage (regenerating) and late stage (non-regenerating) models, to show how BMP would affect the regenerative potential of the joint. This work will provide a foundation for future studies aimed at identifying requirements for regeneration.

Harley Augustine

2:12 pm

Advisor: Dr. Rosalie Anderson**Is *Msx1* Expression a Prerequisite for Regeneration?**

Synovial joints are essential for our everyday activities, making joint health fundamental for quality of life. The inability of the joint to repair or regenerate itself following disease or trauma represents a critical problem in healthcare. By understanding how joints develop and regenerate on a molecular level, researchers can identify factors that contribute to regenerative capabilities. A candidate factor, *Msx1*, has been shown to stimulate repair of the zebrafish fin, regrowth of the mouse digit tip, and regeneration of the amphibian tail and limb. Using the chick embryo as a model, this research investigates the possible role of *Msx1* in joint regeneration. *Msx1* expression as assayed by *in situ* hybridization, is detected in the limb of the chick embryo at various time points. The aim of this research is to determine where the expression of *Msx1* is observed during early development and to compare this to the expression of *Msx1* in the regenerated elbow and in a model of failed joint regeneration. Results show that expression of *Msx1* is seen mostly in the anterior region of the developing limb and in the distal and proximal regions but not directly at the elbow in both controls and the regenerating embryos. The failed regeneration samples show fusion of skeletal elements, and a wider domain of *Msx1* expression in the anterior region that may reflect the upstream control of *Msx1* by Bone Morphogenetic Proteins.

Yuni Borja

1:30 pm

Sponsor: Dr. Elizabeth Beard*Advisor:* Dr. Seth Pincus**Role of CD45RO Signaling in Modulation of HIV Infection.**

In an effort to eradicate the HIV latent reservoir, we study the effects of CD45RO in the kinase-signaling cascade. Previous studies have shown that α CD45RO treatment may play a role in reducing the kinase cascade that follows T-cell activation, and allows the virus to replicate. My project is to determine whether we can use tissue culture cell lines to study this. We have measured the expression of activation markers on the surface of cells using Fluorescence Activated Cell Sorting (FACS). We were able to show activation of cell lines with chemical agents including phorbol 12-myristate 13-acetate (PMA) + ionomycin and Phytohemagglutinin (PHA). We showed that these chemicals induced activation markers. Then we asked if the addition of anti-CD45RO antibody altered this activation. We have encountered some experimental problems that make data interpretation difficult. And we have not yet seen an effect of the anti-CD45 antibody.

Daniel Martin Francis**1:45 pm***Sponsor:* Dr. Rosalie Anderson**Using Immunohistochemistry to Assess Joint Functionality.**

With the use of the chick embryo as a model, this research examines the functionality of the chick limb post-surgery, that is, after the removal of the elbow joint is made early in embryonic development. Studies have shown that the chick joint regenerates after elbow excision is made by cells recapitulating developmental events. Cells dedifferentiate into blastema cells, migrate to the elbow joint and redifferentiate into the regenerated tissue. This study aims to determine the proteins that are present after regeneration; these proteins play a role in cartilage formation, tendon formation, cartilage maturation and limb formation. If these proteins are expressed, this study also aims to examine when and to what degree they are expressed in the joint. Specifically, this study will focus on CD44, N-Cadherin, tenascin, and collagen IX. These proteins are expressed during normal formation of the joint, and if they are found present at the same site after regeneration of the joint, this would suggest that the chick limb would develop a fully functional elbow joint. In this study, the excision is made and the joint is allowed to regenerate for different periods of time, and protein expression is then examined. Immunohistochemistry on histological sections is used to map protein expression in control and experimental embryos.

Luiza Nascimento**2:00 pm***Sponsor:* Dr. Rosalie Anderson**Analysis of the Regenerated Joint: Muscles, Tendons, and Ligaments.**

Successful development and regeneration of the joint can be measured by the effective movement of that member. The synovial joint, an essential structure for locomotion and movement, requires a synovial membrane and fluid, muscles, tendons, and ligaments. Despite our reliance on functioning joints, little is known regarding joint repair and regeneration. Our goal is to analyze the development and regeneration of a synovial joint, the elbow, using the chicken embryo as a model. Regeneration of the joint was analyzed using the "window excision" technique in early embryonic stages. While the regeneration of the joint has been shown by analysis of the skeletal structure, the anatomy of the supporting structures (muscle, tendons, and ligaments) have not been studied. In this study, we used an antibody against sarcomeric myosin to characterize skeletal muscle development, and a tenascin antibody was used to characterize tendon and ligament development. In addition, Mallory's trichrome staining method was used to analyze the complete anatomy of the joint. This study documents the regenerative potential of all tissues involved in joint formation.