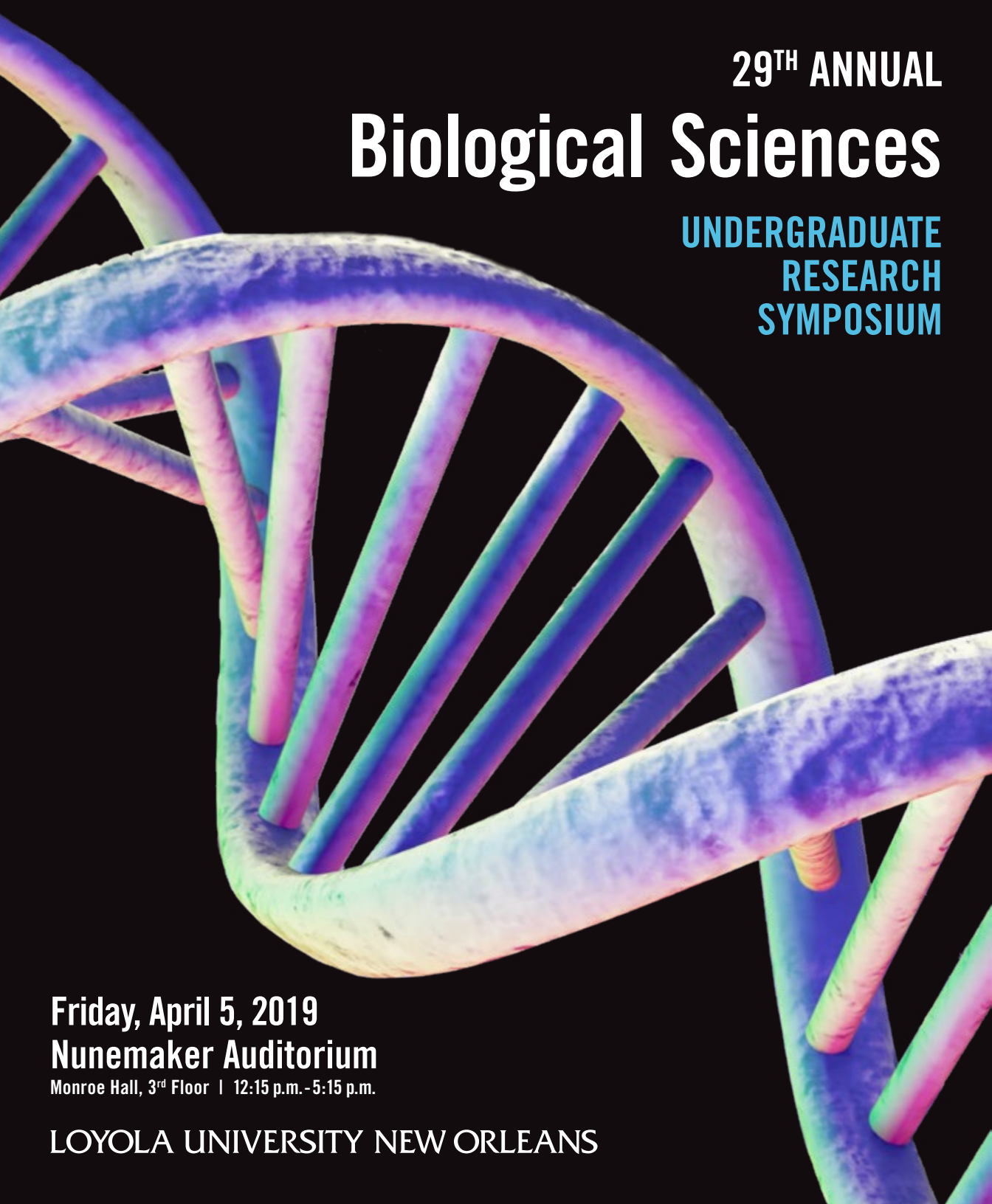

# 29TH ANNUAL Biological Sciences

## UNDERGRADUATE RESEARCH SYMPOSIUM

**Friday, April 5, 2019**
**Nunemaker Auditorium**
Monroe Hall, 3rd Floor | 12:15 p.m.-5:15 p.m.

LOYOLA UNIVERSITY NEW ORLEANS

# 29TH ANNUAL
# Biological Sciences
## UNDERGRADUATE RESEARCH SYMPOSIUM

| | | | |
|---|---|---|---|
| 12:15 | RECEPTION | | |
| 12:45 | OPENING REMARKS | | |
| 1:00 | Shannon Hester | Dr. Aimée Thomas | Impact of Urban Park Management on Ground Dwelling Spider Communities |
| 1:15 | Andrew Harper | Dr. Aimée Thomas | Urban Park Management Effects on Odonate Communities |
| 1:30 | Claire Commagere | Dr. Aimée Thomas | Green Infrastructure: Living with Water Sustainably |
| 1:45 | Ella Hall | Dr. Aimée Thomas | Effect of Urban Park Management on Aquatic Macroinvertebrate Communities |
| 2:00 | Leslie Galvez | Dr. Aimée Thomas | The Effect of Vertical Gardens on Invertebrate Biodiversity within an Urban Environment |
| 2:15-2:30 | 15 MINUTE BREAK | | |
| 2:30 | Margaret Adams | Dr. Phil Bucolo | Palatability of Invasive Plant *(Myriophyllum spicatum)* to Local Mud Crab *(Rhithropanopeus harrisii)* |
| 2:45 | Julia Racine | Dr. Rosalie Anderson | Collagen II Expression in the Regenerated Joint of Gallus gallus during Articular Cartilage Development |
| 3:00 | Kyle Cleveland | Dr. Rosalie Anderson<br>Dr. Karen Rosenbecker | Ideal Movements for Optimal Muscle Growth and Development |
| 3:15 | Kristen Williams | Dr. Suresh Alahari<br>Dr. Shengli Dong<br>Dr. Don Hauber | The Synergistic Effect of Drugs on Triple Negative Breast Cancer Cell Lines |
| 3:30-4:00 | 30 MINUTE BREAK | | |
| 4:00 | Robert Mipro | Dr. Susan Chiasson | A Survey: Student Knowledge and Use of Opioids |
| 4:15 | Sandrine Ferrans | Dr. Rana Adhikari<br>Dr. Martin McHugh | Characterizing Mirror Figure Error in LIGO with In-Situ Laser Mode Spectroscopy |
| 4:30 | Coleman Green | Dr. Luca Celardo<br>Dr. Armin Kargol | The Effect of Geometry on Macroscopic Quantum Coherence in Light-Harvesting Nanotubular Complexes |
| 4:45 | Anna Smith<br>Kennedi Turner<br>(joint presentation) | Dr. Tirthabir Biswas | Dynamic Modeling of Photoreceptors: Peak Responses and Adaptations to Varying Stimuli |
| 5:00 | Arden LaGrone | Dr. Aimée Thomas | Using Bioacoustics Data to Determine the Effects on Anuran Communities in Coastal Louisiana |
| 5:30 | CRAWFISH BOIL | | |



# IMPACT OF URBAN PARK MANAGEMENT ON GROUND DWELLING SPIDER COMMUNITIES

**SHANNON HESTER**
STUDENT PRESENTER

**DR. AIMÉE THOMAS**
RESEARCH ADVISOR

Spiders (Arachnida, Araneae) are vital to maintaining and sustaining urban ecosystems, yet remain understudied in the areas where their impact is most measurable. Due to their elusive nature, ground-dwelling spiders are particularly challenging to observe. To establish a baseline of local spider communities as well as test the productivity of pitfall traps, ground-dwelling spiders from three distinct locations within New Orleans City Park were sampled once per month from August 2017-October 2017 during both day and night. Spiders were sampled within three 10x10 meter plots at each location using hand collections and deploying pitfall traps for 24 hours on the corners of the plots. Specimens were identified to family according to *Spiders of North America: An Identification Manual* (2009) and other dichotomous keys. Fifteen spider families were identified with spiders of the family Lycosidae comprising about half of the entire sample, dominating both the South Golf Course and Wisner Tract while the family Tetragnathidae dominated Couturie Forest. All locations yielded similar abundance and richness values. The data collected contributed to a year-long BioBlitz project in New Orleans City Park with an end goal of compiling a list of all the species present in the park in order for park administration to make more sustainable development decisions.

# URBAN PARK MANAGEMENT EFFECTS ON ODONATE COMMUNITIES

**ANDREW HARPER**
STUDENT PRESENTER

**DR. AIMÉE THOMAS**
RESEARCH ADVISOR

New Orleans City Park is a 1300-acre urban park that hosts a variety of habitats for organisms. The park is constantly changing to accommodate visitors, but no studies have been completed to establish a baseline of the flora and fauna already found in the park. Three unique habitats studied, a human-planted forest (Couturie Forest), a PGA-standard golf course, and an abandoned golf course, turned grassland (Wisner Track), experience different levels of maintenance by park staff. The goal of this study was to establish a baseline of the Odonate communities within City Park and assess the effects of maintenance (disturbance) on the Odonates found in each habitat. Previous studies indicate no significant difference when comparing golf course ponds to nature-preserve ponds. Because of this, I hypothesized that the golf course and Couturie Forest lagoons would not have significant differences in Odonate populations, but that there would be a difference between those lagoons and the Wisner Track lagoon, which receives no maintenance from park staff. All three habitats were sampled once each season over a year. A 100ft transect was randomly placed along the lagoon wherein we used dip nets to collect Odonate naiads every 25ft, creating a total of five sample points from each lagoon. Preliminary results suggest a trend in greater diversity in Odonate naiads within the South Golf Course lagoon. This project will help inform future management practices of the City Park lagoons to increase the health of these systems.



# GREEN INFRASTRUCTURE: LIVING WITH WATER SUSTAINABLY

**CLAIRE COMMAGERE**
STUDENT PRESENTER

**DR. AIMÉE THOMAS**
RESEARCH ADVISOR

New Orleans is famous for its food, culture, and music. Unfortunately, New Orleans is just as well known for flooding, potholes, and poor water quality control. These problems are the result of location, grey infrastructure, and pollution. In order to combat these challenges green infrastructure must be integrated into stormwater management plans. Water gardens are green infrastructures that capture and filter water, instead of attempting to pump it all out. This is done by slowing the flow of water and allowing it time to be absorbed by the surrounding environment. As the water is being captured it is also filtered by the sediment and plant life. I propose to integrate a water garden on Loyola University of New Orleans' campus and develop a curriculum based on the Mirabeau Water Garden to educate the public. Developing water gardens would help prevent flooding and subsidence and reduce pollution. Water gardens are beautiful, environmentally sustainable, and cost-effective alternatives to grey infrastructure.

# EFFECT OF URBAN PARK MANAGEMENT ON AQUATIC MACROINVERTEBRATE COMMUNITIES

**ELLA HALL**
STUDENT PRESENTER

**DR. AIMÉE THOMAS**
RESEARCH ADVISOR

New Orleans City Park experiences many different levels of disturbance due to a range of habitats and maintenance throughout the park. Not only does the park include miles of biking and hiking trails through a forest, but there is also a lagoon system and an 18-hole golf course. This study divided the park into three different sample areas: Wisner Track, Couturie Forest, and the golf course. Five water samples per location were taken from these areas each season for one year. Water samples were specifically collected in order to focus on the aquatic macroinvertebrate communities in each area because many of these species are only able to tolerate certain levels of disturbance and pollution, making them good bioindicators. The tolerance levels of these aquatic macroinvertebrates can be assessed using the Hilsenhoff Biotic Index, a 1-10 scale in which low numbers represent more pollutant sensitive organisms and high numbers represent less pollutant sensitive organisms. Because the park's golf course is likely to have the most pollution due to fertilizer runoff, aquatic macroinvertebrate communities with higher Hilsenhoff values are more likely to be abundant there, although this area will likely have the lowest biodiversity. Meanwhile, Couturie Forest seems to have the least amount of disturbance, so that location will likely have the most biodiversity and lower Hilsenhoff values. Pollution levels of each area can be used to inform future management practices to lessen the disturbance and pollution in this 2.5 square mile park.



# THE EFFECT OF VERTICAL GARDENS ON INVERTEBRATE BIODIVERSITY WITHIN AN URBAN ENVIRONMENT

**LESLIE GALVEZ**
STUDENT PRESENTER

**DR. AIMÉE THOMAS**
RESEARCH ADVISOR

Vertical gardens are an innovative architecture that incorporates vegetation within the urban landscape. In this study, invertebrate species diversity is described from six vertical gardens from Quito, Ecuador. It was predicted that species richness would increase as the total area of the garden increased due to the species-surface area relationship. A second hypothesis was tested which was based on conclusions from a previous study by Madre *et al*. (2015). According to that study, hydroponic vertical gardens have greater species diversity compared to substrate vertical gardens. Six gardens were used in this study from central and northern Quito, Ecuador: PUCE Exterior, PUCE Interior, Platform, ENNE, Museum Alabado, and San Blas. Each garden was sampled three times in a span of 3 months (May - July 2018) using three methods (beat sheet, net sweeps, and pitfall traps), in order to collect as many individuals as possible to determine the overall species composition.  Results show a positive correlation between the total area of the vertical garden and biodiversity and a statistical difference in large (>20m) versus medium (20-5m) and large versus small (<5m) gardens. These findings are consistent with the species-surface area relationship. Hydroponic gardens support more diverse insect fauna than substrate gardens. Future research should explore the relationship between specific taxa and the plant composition of the garden.

# PALATABILITY OF INVASIVE PLANT *(MYRIOPHYLLUM SPICATUM)* TO LOCAL MUD CRAB *(RHITHROPANOPEUS HARRISII)*

**MARGARET A. ADAMS**
STUDENT PRESENTER

**DR. PHILIP BUCOLO**
RESEARCH ADVISOR

The escalating spread of invasive vegetative species increases the possibilities of disturbances in the survival and proliferation of native macrophyte and invertebrate communities in aquatic ecosystems. Presently, the inadequate knowledge regarding the effects of the rapid introduction to a non-native species highlights the need for more exploration into these interactions. Aquatic macrophytes are expected to play a crucial role in the survival and propagation of invertebrates and in the complexity of these ecosystems. We collected the invasive subtidal macrophyte, Eurasian watermilfoil *(Myriophyllum spicatum)* from Marquez Canal, located off Chef Menteur Pass, Southeast Louisiana. Within these sampling locations, we observed and collected North American mud crabs, *Rhithropanopeus harrisii*, via throw trap to explore the possible palatability of the Eurasian watermilfoil. To these omnivorous crabs, our results illustrate that Eurasian watermilfoil supports the dietary requirements of *R. harrissi*. This result illustrates the demand to consider contributions of non-native populations for comprehensive understanding of community dynamics.



# COLLAGEN II EXPRESSION IN THE REGENERATED JOINT OF *GALLUS GALLUS* DURING ARTICULAR CARTILAGE DEVELOPMENT

**JULIA RACINE**
STUDENT PRESENTER

**DR. ROSALIE ANDERSON**
RESEARCH ADVISOR

Regenerative medicine holds much promise for treating common diseases such as osteoarthritis, the degeneration of articular cartilage. For regenerative medicine to be effective in treating the joints, relevant developmental or healing signals must be identified and activated with appropriate timing and placement. Although mRNA transcripts of the *Col2a1* gene have been studied extensively to elucidate differentiation of prechondrogenic mesenchymal cells into chondrocytes, the literature is currently lacking a description of collagen IIA protein expression in the context of joint regeneration in the forelimb. For this reason, an assessment of collagen IIA expression in the forelimb of the *Gallus gallus* joint regeneration model was undertaken. Using immunohistochemistry to locate collagen IIA at various developmental stages, a comparison of regenerated articular cartilage to native articular cartilage was conducted to illustrate the regenerative abilities of articular cartilage after window excision surgery.

# IDEAL MOVEMENTS FOR OPTIMAL MUSCLE GROWTH AND DEVELOPMENT

**KYLE CLEVELAND**
STUDENT PRESENTER

**DR. ROSALIE ANDERSON** AND **DR. KAREN ROSENBECKER**
RESEARCH ADVISOR

Throughout history, from the time of antiquity to modern day, there has been a quest to obtain an ideal physique through lifting weights. Despite this historical interest, research regarding the correct movements and manner in which to perform these movements, including body positioning, load, and duration of intervals, is lacking. Moreover, while there is general knowledge in the modern sport of bodybuilding regarding which movements target specific regions of muscle, a scientific approach is often overlooked. The overabundance of movements is easy to observe in body-building — with each athlete claiming a specific movement is the key to most efficiently and effectively induce muscular hypertrophy. Prior research has shown specific factors that can maximize hypertrophic results, such as body positioning, mechanical tension, and overall muscle damage induced during weight training, for specific muscle groups. Therefore, the goal of this project is twofold: (a) review the literature regarding ideal movements to induce maximized hypertrophy most efficiently, and (b) to conclude, from this research, which movements will induce optimal muscle growth and development, for each muscle group.



# THE SYNERGISTIC EFFECT OF DRUGS ON TRIPLE NEGATIVE BREAST CANCER CELL LINES

**KRISTEN WILLIAMS**
STUDENT PRESENTER

**DR. SURESH ALAHARI** AND **DR. SHENGLI DONG**
LOUISIANA STATE UNIVERSITY HEALTH NEW ORLEANS SCHOOL OF MEDICINE
RESEARCH ADVISORS

**DR. DONALD HAUBER**
RESEARCH SPONSOR

Breast cancer is a leading cause of death for women. About 1 in 8 U.S. women will develop an invasive breast cancer in their life. Triple-Negative Breast Cancer (TNBC) is an aggressive form of cancer that lacks the estrogen receptor (ER), the human epidermal grow factor receptor 2 (HER2), and progesterone receptor (PR) expression. As a result, TNBC cannot be cured by the existent hormonal therapies. Therefore, there are urgent unmet medical needs to develop more effective target drugs for helping to treat patients with TNBC. Myeloid cell leukemia-1 (Mcl-1) is an anti-apoptotic protein. The Mcl-1 gene is one of the top ten overexpressed genes in breast cancers. The Mcl-1 gene is amplified in 54% of post neoadjuvent therapy in TNBCs. Over 40% of tested human TNBC cells are dependent upon Mcl-1 for survival. Thus, Mcl-1 is a highly promising drug target for TNBC. LSU594 is a quinolinium derivative small molecule.  We found that LSU594 treatment induced cancer cell apoptosis through Mcl-1 inhibition in TNBCs. Rapamycin, LSU594, Everolimus, and Temsirolimus inhibit TNBC cell growth and decrease TNBC cell viability. This study showed that there is a synergistic effect of the drugs at varying concentrations that can reduce the TNBC cell viability. Results of Western Blot also showed the inhibition of the PI3K/AKT/mTOR pathway and Wnt signaling pathway which lead to cell apoptosis. In the future, these drugs can be tested on TNBC tumors by *in vivo* animal studies and develop drug therapy to advance personalized medicine for TNBC.

# A SURVEY: STUDENT KNOWLEDGE AND USE OF OPIOIDS

**ROBERT MIPRO**
STUDENT PRESENTER

**DR. SUSAN CHIASSON**
RESEARCH ADVISOR

The over-prescription of opioids concomitant with the availability of illegal drugs has led to an epidemic. This epidemic has adversely affected the Loyola community as several students have overdosed on opioids. A survey was conducted in various classrooms to determine both the knowledge level and use of opioids in the College of Arts & Sciences and in the College of Business. A total of 117 individuals responded to the survey. Approximately half the participants watched an informational presentation, while the other half only took the survey. The main objectives of this research were to determine the percentage of students reporting opioid abuse, student knowledge of the effects of opioids, and their knowledge of the availability of a potentially life-saving drug. The preliminary results showed that 8.6% of students reported opioid abuse by themselves or a college aged friend. Those who watched the educational presentation scored higher on fact based survey questions (average score=6/8) than those who did not view the presentation (average score=4.7/8). This shows the efficacy of the opioid educational presentation and the need for more active educational intervention. Data collected from the survey was further analyzed using a one way ANOVA and t-tests.



# CHARACTERIZING MIRROR FIGURE ERROR IN LIGO WITH IN-SITU LASER MODE SPECTROSCOPY

**SANDRINE FERRANS**
STUDENT PRESENTER

**DR. RANA ADHIKARI** CALIFORNIA INSTITUTE OF TECHNOLOGY
RESEARCH ADVISOR

**DR. MARTIN MCHUGH**
RESEARCH SPONSOR

The LIGO detectors are Michelson based interferometers with Fabry Perot cavities. The Fabry Perot cavities in LIGO create an optical resonator with semi-transparent spherical mirrors, where light is reflected and transmitted before being merged into an interference pattern. However, the mirrors are not perfect and contain surface defects which cause optical power losses, reducing the sensitivity to detect gravitational waves. This project is focused on improving the sensitivity in LIGO by characterizing mirror figure error that contributes to optical losses in the laser. Surface perturbations are evaluated with in-situ laser mode spectroscopy by inserting an auxiliary laser and a thermal heater into the 40 meter LIGO prototype. Mirror figure error will cause the resonant frequencies of the Hermite-Gaussian modes to shift from their ideal theoretical spacings. A heater was inserted to create a known deformation in the mirror and a large shift in the transverse mode spacings. Mirror phase maps, a physical representation of the mirror, can be reconstructed by analyzing the shift in transverse mode spacings with Markov Chain Monte Carlo methods. By mapping the surface of the mirror down a precision of 1 angstrom, the optical losses and noise can be evaluated and therefore minimized.

# THE EFFECT OF GEOMETRY ON MACROSCOPIC QUANTUM COHERENCE IN LIGHT-HARVESTING NANOTUBULAR COMPLEXES

**COLEMAN GREEN**
STUDENT PRESENTER

**DR. ARMIN KARGOL** LOYOLA UNIVERSITY NEW ORLEANS
**DR. LUCA CELARDO** BUAP PUEBLA, MEXICO
RESEARCH ADVISORS

We study nanotubular self-aggregates of chlorophyll molecules, which are essential for light harvesting and energy transport in photosynthesizing Green Sulphur Bacteria. If these structures are well understood, then we can potentially replicate them in labs and create efficient photoreceptors. A quantum mechanical model of a mutant variety of Green Sulphur Bacteria (Mutant Type) has shown that these structures, which are stacks of rings of 60 photoactive molecules with large transition dipoles, support quantum coherences at room temperature. Consequently, photoexcitations can be delocalized over many molecules. This leads to the emergence of superradiant states, which absorb and emit light at much faster rates than a single molecule. However, the strength of these effects depends on the geometric arrangement of these structures. To further study the role of geometry, we changed parameters, such as the orientation of the dipoles, and compared the results to the original structure. We found that photoexcitonic delocalization is sensitive to these changes. We then created an entirely new model based around the golden mean (Golden Mean Type) and showed that it also supports superradiant states. Lastly, we studied a model with entirely random positions for the molecules and showed that these quantum effects disappear. So, an open question is to understand the relationship between delocalization and dipole strength. In the future we hope to answer this question by studying the geometries that optimize these effects.



# DYNAMIC MODELING OF PHOTORECEPTORS: PEAK RESPONSES AND ADAPTATIONS TO VARYING STIMULI

**ANNA SMITH** AND **KENNEDI TURNER**
STUDENT PRESENTER

**DR. TIRTHABIR BISWAS**
RESEARCH ADVISOR

Photoreceptors generate biological responses as a result of stimulation via light. The purpose of this research project is to mathematically model photoreceptor responses such that key aspects are quantitatively captured, such as observed adaptation over time and saturation under extreme stimulus. Past photoreceptor models were examined and modified to yield a new dynamic model that provides an excellent fit to data capturing the responses of the retinal photoreceptor cells under a variety of stimulus conditions. Stimulus conditions include bright and “dark” flashes of light on top of some given initial background illumination. Quantitative analysis strongly suggests that a direct coupling of membrane potential to light stimuli is not sufficient to capture the behavior of photoreceptors. Nonlinear coupling between the membrane potential and some internal variable that controls adaptation in the cell is necessary to accurately predict the photoreceptor response. On one hand this research may provide insight into the microphysical processes inside the cell, and on the other, help improve exploration of the complexities of neural networks.

# USING BIOACOUSTICS DATA TO DETERMINE THE EFFECTS ON ANURAN COMMUNITIES IN COASTAL LOUISIANA

**ARDEN LAGRONE**
STUDENT PRESENTER

**DR. AIMÉE THOMAS**
RESEARCH ADVISOR

The permeable nature of their skin and aquatic life history allows anurans to serve as vital indicator species. Without them, an integral piece of aquatic ecosystems and a vital tool for gauging the health of these ecosystems is lost. These organisms can be impacted by a number of factors, two of which include salinity and water depth. Previous studies have indicated that increases in salinity can lead to a decrease in an ecosystem's ability to sustain anuran communities because anurans are unable to regulate their osmolarity. It has also been indicated that water depth can impact anuran communities, with anurans more likely to reside in shallow water due to the greater availability of small fish and frogs for prey as well as a decreased likelihood of larger predators. Using Song Scope Bioacoustics Monitoring Software, the goal of this study was to analyze 48 remote sites for the vocalizations of five anuran species *(Hyla cinerea, Lithobates catesbeianus, L. clamitans, L. grylio, and L. sphenocephalus)*. I hypothesized that sites with lower salinities and shallow water depths would display a higher diversity of anuran species. Our data indicate that there is a significantly greater diversity of anuran species in locations with low salinities and shallow water. With this study, we establish baseline data for the communities of these anuran species present at each site, and will allow future researchers to form assumptions about the impact that changes in salinity and water depth will have in the future.



## NOTES

# NOTES



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29TH ANNUAL

# Biological Sciences

## UNDERGRADUATE RESEARCH SYMPOSIUM

Today we celebrate 29 years of outstanding undergraduate research at Loyola. The students who present their projects today 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 **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 our donors for their continued support of this event and our wonderful students.

## GUEST SYMPOSIUM EVALUATORS

Andrea Alarcon, Gabby Espiritu, Mindy Ngo, Tom Sevick, and Caroline Stallard

LOYOLA UNIVERSITY NEW ORLEANS | COLLEGE OF ARTS AND SCIENCES

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