
35TH ANNUAL
UNDERGRADUATE RESEARCH SYMPOSIUM
HOSTED BY BIOLOGICAL SCIENCES
Friday, April 11, 2025
Miller Hall 114 | 11:00 a.m.– 4:30 p.m.
LOYOLA UNIVERSITY NEW ORLEANS
COLLEGE OF ARTS AND SCIENCES

35th ANNUAL BIOLOGICAL SCIENCES UNDERGRADUATE RESEARCH SYMPOSIUM

FRIDAY, APRIL 11, 2025 · MILLER 114 · 11:00 – 4:30

Time	Presenter	Advisors	Description
11:00	**RECEPTION**		
11:45	**OPENING REMARKS**		
12:00	Madison Roig*	Dr. Kimberlee Mix	Regulation of orphan nuclear receptor 4A2 (NR4A2) in human chondrocytes
12:15	Hooreya Abbas*	Dr. Kimberlee Mix	Histological analysis of joint inflammation and bone erosion in rheumatoid arthritis
12:30	Nina Ratusznik	Drs. C.J. Stephenson, Anna Duggar, & Aimée Thomas	Method development for the quantification of herbicide pollutants in dragonfly nymphs
12:45	Lucy McCain	Prof. Susan Thomassie & Dr. Frank Jordan	Designing species-specific eDNA protocol for detecting *Amphipnous cuchia* in Bayou St. John
1:00	**15 MINUTE BREAK**		
1:15	Paola Ameglio	Dr. Laurie Earls	Don't touch my Pants: a lesson in protein-protein interactions
1:30	Rowan Sawyer*	Dr. Allyn Schoeffler	Investigation of supercoiling activity by a mesophilic gyrase variant with a psychrophilic modification
1:45	Lily Manzi	Dr. Allyn Schoeffler	Creating a python linear extrapolation fitting code to analyze protein denaturation data
2:00	Aimee Martin*	Dr. Amrita Datta	The role of fat cadherins in breast cancer
2:15	**15 MINUTE BREAK**		
2:30	Honora Sullivan	Drs. Laurie Earls & Tatsuo Kawai	Measuring antibody mediated rejection in post-xenotransplant nonhuman primates
2:45	Jinnah Parrish*	Dr. Anna Duggar	Enhancing latent fingerprint detection: investigating the performance of the Full Spectrum Imaging System

Time	Presenter	Advisors	Description
3:00	Owen Taylor	Drs. Armin Kargol & Anat Burger	Modeling hysteretic conductance to extrapolate shaker potassium ion channel gating behavior
3:15	**15 MINUTE BREAK**		
3:30	Elysse June*	Dr. Christine Heinecke	Correlation between alkali metal acetate precipitating salts and ligand capped gold nanoclusters
3:45	Andre Hoyuela	Dr. Shane McGlynn	Synthesis and characterization of organometallic complexes via spectroscopic techniques for material design
4:00	Delaney Mathis	Dr. Bill Walkenhorst	Searching for synergistic antimicrobial activity between silver nanoparticles and toxic ions
4:30	**CRAWFISH BOIL**		

*Student member of Beta Beta Beta (Tri Beta) which is a national honor society for students, particularly undergraduates, dedicated to improving the understanding and appreciation of biological study and extend boundaries of human knowledge through scientific research. The Eta Lambda Chapter of Tri Beta was established at Loyola University New Orleans by Father Mullahy, S.J. in 1956. Students joining Tri Beta are encouraged to contact faculty advisor Dr. Kim Mix (mix@loyno.edu).

REGULATION OF ORPHAN NUCLEAR RECEPTOR 4A2 (NR4A2) IN HUMAN CHONDROCYTES

MADISON ROIG
STUDENT PRESENTER

DR. KIMBERLEE MIX
RESEARCH ADVISOR

Osteoarthritis (OA) is a leading cause of joint pain and disability in adults in the United States. OA affects the entire joint, leading to cartilage degradation and bone erosion. This disease is predominantly found in weight bearing joints. Orphan nuclear receptor 4A2 (NR4A2) is a constitutively active transcription factor that is expressed at elevated levels in OA cartilage and inflamed tissues. NR4A2 downregulates genes involved in cartilage metabolism, potentially having a protective function in joints. Oxidative stress conditions increase during OA progression and aging, leading to a number of modifications in target proteins and nucleic acids. We hypothesize that NR4A2 protein is oxidized in response to oxidative stress conditions in chondrocytes. This may decrease transcriptional activity of the receptor and alter cartilage metabolism in OA. The objectives of this study were to optimize conditions for detection of NR4A2 by Western blotting and to establish the kinetics of NR4A2 protein modifications in response to oxidative stress. Immortalized human chondrocyte cells (C28I2) were treated with prostaglandin E2 (PGE2) and hydrogen peroxide as a model for oxidative stress. Nuclear and cytoplasmic proteins were extracted from cells, and NR4A2 was detected by Western blotting. Consistent with previous results, NR4A2 protein was potently induced after one hour of PGE2 treatment. Likewise, hydrogen peroxide rapidly induced NR4A2 protein at concentrations that were not toxic to cells, demonstrating that oxidative stress conditions increase receptor expression. Future studies will identify NR4A2-target genes regulated by oxidative stress and define the amino acids of NR4A2 modified by oxidative stress conditions.

HISTOLOGICAL ANALYSIS OF JOINT INFLAMMATION AND BONE EROSION IN RHEUMATOID ARTHRITIS

HOOREYA ABBAS
STUDENT PRESENTER

DR. KIMBERLEE MIX
RESEARCH ADVISOR

Rheumatoid arthritis (RA) is an autoimmune disorder identified by synovial inflammation, bone erosion, and cartilage degradation affecting several joints. Tumor necrosis factor-alpha (TNF-α), a pro-inflammatory cytokine, plays an important role in RA pathogenesis and is a primary therapeutic target. The purpose of this study was to test the efficacy of novel anti-inflammatory agents in transgenic mice expressing human TNF-α (hTNF-α). Twelve-week-old male hTNF-α mice were treated with novel anti-inflammatory agents for six weeks. PBS-treated hTNF-α and wild-type (WT) mice served as controls. Histological analysis of paw tissue sections was performed to analyze disease progression and response to treatment. Front and hind paw sections were stained with Safranin-O (Saf O) and Hematoxylin and Eosin (H&E), and images were collected using an Olympus microscope BX51 equipped with a digital camera. Synovial inflammation, proteoglycan loss, cartilage degradation, and bone erosion were semi-quantitatively scored and CellSens software was used for quantitative measurements of bone erosion. Results indicate a significant reduction in inflammation and bone erosion in hTNF-α mice treated with novel anti-inflammatory agents relative to the controls. Histological results were correlated with changes in paw swelling in clinical findings. This study contributes to understanding TNF- α mediated inflammation and supports the exploration of novel anti-inflammatory agents as potential therapies.

METHOD DEVELOPMENT FOR THE QUANITIFICATION OF HERBICIDE POLLUTANTS IN DRAGONFLY NYMPHS

NINA RATUSZNIK
STUDENT PRESENTER

DRS. C.J. STEPHENSON, ANNA DUGGAR, & AIMÉE THOMAS
RESEARCH ADVISORS

Active chemicals in applied herbicides are considered persistent organic pollutants, known for their high persistence and toxicity in the environment and organisms. Once released into the environment, these compounds are known to partition into the tissue of organisms and bioaccumulate throughout the food web, causing adverse effects, even in non-target organisms. A functioning ecosystem depends largely on the presence of invertebrates, such as dragonflies (family: *Odonata*). As semi-aquatic and mid-trophic level organisms, the abundance and diversity of dragonfly nymphs are a proxy for the overall health of an ecosystem. Analyzing the accumulation of herbicide pollutants within dragonfly nymphs is a useful proxy for the presence and concentration of selected herbicides within the ecosystem. Herein, is a discussion of the analysis of herbicide pollutants in dragonfly nymphs via liquid chromatography-mass spectrometry (LC-MS/MS). The QuEChERS (Quick, Easy, Cheap, Effective, Rugged, Safe) extraction method was adapted to prepare dragonfly nymph field samples collected from aquatic environments in New Orleans, Louisiana for analysis. This discussion will focus heavily on method development, emphasizing the sensitivity of LC-MS/MS and presenting the study's initial results and future direction. The ecological implications of the results will be discussed.

DESIGNING SPECIES-SPECIFIC EDNA PROTOCOL FOR DETECTING *AMPHIPNOUS CUCHIA* IN BAYOU ST. JOHN

LUCY McCAIN
STUDENT PRESENTER

PROF. SUSAN THOMASSIE & DR. FRANK JORDAN
RESEARCH ADVISORS

Amphipnous cuchia is a species of obligate air-breathing swamp eel from Southeast Asia that was discovered in Bayou St. John in New Orleans in the summer of 2019. It has proven difficult to monitor the abundance and spread of this potentially invasive species using traditional sampling methods (e.g., seines and throw traps) because Cuchia are nocturnal, fossorial, and occupy densely vegetated habitats. To overcome these difficulties, we are developing an eDNA assay to detect the presence of Cuchia DNA in water samples collected from monitoring sites in Bayou St. John and adjacent water bodies. To create the eDNA assay, we designed species-specific primers and probes targeting ~150bp regions of the COI and Cytb genes. We are using PCR and qPCR to test functionality and specificity of these primers/probes using DNA isolated from tissue samples from Cuchia and other fish species caught in Bayou St. John, and swamp eel specimens from other populations established in Texas and Florida. We will also determine the limit of detection for each primer/probe set, as well as how many days can pass after DNA is released into the water for the primer to remain effective. Ideally, our eDNA assay will provide fishery managers with an accurate and relatively inexpensive tool to monitor the invasion dynamics of Cuchia in Bayou St. John and beyond.

DON'T TOUCH MY PANTS: A LESSON IN PROTEIN-PROTEIN INTERACTIONS

PAOLA AMEGLIO
STUDENT PRESENTER

DR. LAURIE EARLS
RESEARCH ADVISOR

The micropeptide Pants plays a critical role in hippocampal synaptic plasticity during early adult maturation in mice. Early adulthood is a vulnerable developmental period linked to schizophrenia onset and later cognitive decline. To understand the molecular mechanisms through which Pants influences hippocampal function, we examine its interactions with two protein targets: Nogo-A, localized primarily in CA3, and NCam-1, found in the CA2 hippocampal subregion. Using site-directed mutagenesis, we have generated Pants mutants to identify critical residues for selective binding. These mutants will be evaluated using proximity-labeling assays to identify differential interactions with Nogo-A and NCam-1. This will allow us to determine the residues responsible for region-specific protein binding in the hippocampus, providing crucial insights into the molecular mechanisms underlying hippocampal plasticity. Understanding these region-specific interactions may help identify molecular targets relevant to psychiatric disorders and cognitive impairment.

INVESTIGATION OF SUPERCOILING ACTIVITY BY A MESOPHILIC GYRASE VARIANT WITH A PSYCHROPHILIC MODIFICATION

ROWAN SAWYER
STUDENT PRESENTER

DR. ALLYN SCHOEFFLER
RESEARCH ADVISOR

Psychrophilic, cold-loving, bacteria function and maintain extremophilic enzyme activity in near-freezing environments that are not hospitable to mesophilic, moderate-loving, organisms. Prior work on the bacterial enzyme gyrase has found an amino acid motif known as the cold box in psychrophilic gyrase genes. We hypothesize the cold box is important for the temperature-dependent activity of psychrophilic gyrase. To test this hypothesis, created, expressed, and purified a variant of the GyrA gene from *E. coli*, a mesophile, in which the cold box has been added by mutagenesis. After combining GyrA and GyrB subunits to form the gyrase tetramer, we tested the wild-type and mutant tetramers for DNA supercoiling activity. Future studies will test activity at different temperatures. The GyrA cold box motif mutation, at the 666 position from a leucine to a proline, may affect enzyme activity, and this study has implications for better understanding psychrophilicity.

CREATING A PYTHON LINEAR EXTRAPOLATION FITTING CODE TO ANALYZE PROTEIN DENATURATION DATA

LILY MANZI
STUDENT PRESENTER

DR. ALLYN SCHOEFFLER
RESEARCH ADVISOR

This project investigated whether a “homemade,” python-programmed linear extrapolation fitting code can be used to analyze experimental data on protein chemical denaturation. Utilizing a Jasco J-810 circular dichroism (CD) spectrophotometer, spectra of proteins equilibrated in a range of different concentrations of urea (a chemical denaturant) were collected. Signal at 222 nm (the wavelength associated with folded alpha helices) was determined. By observing the unfolding of alpha helices, the fraction of folded protein at different denaturant concentrations can be assessed. We created a nonlinear fitting program in python to accept CD signal and denaturant concentration values, fit these data to the linear extrapolation method function, and output fittable parameters. Thus a value for the ΔG of protein unfolding (ΔG(unf)) can be obtained. The expected result of this experiment is for the python program to replicate published values for ΔG(unf), consequently showing that an “in-house” python fitting code is a practical method of extracting and analyzing experimental data on protein chemical denaturation.

THE ROLE OF FAT CADHERINS IN BREAST CANCER

AIMEE MARTIN
STUDENT PRESENTER

DR. AMRITA DATTA
RESEARCH ADVISORS

Cancer metastasis is the major cause of cancer morbidity and mortality and accounts for about 90% of cancer deaths. It is critical to understand the underlying molecular mechanisms driving metastasis to identify early markers of cancer progression and biomarkers for therapeutic intervention.

The newly discovered Fat cadherins are giants of the cadherin superfamily and have tissue specific roles in development. Fat cadherin expression may be lost or gained in cancer and their role in cell adhesion, epithelial to mesenchymal transition, invasion and migration (all drivers of metastasis) is poorly understood. Our study explores the role of Fat cadherins in breast cancer metastasis.

Our preliminary analysis using The Cancer Genome Atlas program (TCGA) has shown that Fat cadherins are among the top dysregulated genes in cancer and correlate with poor patient survival. We have also previously discovered that FAT cadherins are differentially expressed in the metastatic MDA-MB-231 cells and the non-metastatic MCF-7 cells. In this project we will knock out FAT cadherins and analyze their role in invasion and metastasis. We will also delineate the signaling mechanisms driving FAT induced metastasis through PCR and western blot. The long-term goal of this study is to prove the oncogenic role of FAT cadherins in metastatic breast cancer. And further investigations into FAT cadherin-driven metastasis will be important for identifying their role as patient biomarkers and targets for therapeutic intervention.

MEASURING ANTIBODY MEDIATED REJECTION IN POST-XENOTRANSPLANT NONHUMAN PRIMATES

HONORA SULLIVAN
STUDENT PRESENTER

DR. LAURIE EARLS
RESEARCH ADVISOR

DR. TATSUO KAWAI
RESEARCH ADVISOR – HARVARD MEDICAL SCHOOL; MASSACHUSETTS GENERAL HOSPITAL

It is estimated that, every day, roughly 160 people are added to the organ transplant list while 17 people die waiting. It is well understood in the transplant field that the overwhelming demand for organs is simply not met by the supply. This is where the burgeoning field of xenotransplantation offers the exciting possibility of using nonhuman organs for human recipients. A small study was conducted that was part of a much larger body of research investigating xenotransplantion in the Kawai/Cosimi Lab at Massachusetts General Hospital. In this study IgG and IgM antibodies were analyzed in 18 nonhuman primates (NHPs) who underwent xenotransplantation. Serological assays were conducted using several serum samples from the NHP and combining each of them with a single sample of peripheral mononuclear blood cells (PBMC) from their specific porcine donor. Serum from the NHPs was taken at multiple different dates; ranging from just prior to transplant to their eventual date of euthanasia. These consecutive samples are each mixed with their donor's sample of PBMC to allow for antibodies to- potentially- develop from the NHP serum to attack the donor PBMC. This allows for antibody presentation to be tracked across the NHPs post-transplant lifespan and detect for antibody mediated rejection (AMR). The presence of antibodies was analyzed using flow cytometry- or FACS analysis- to detect AMR. This data can help to better understand the efficacy of the techniques being used in preliminary xenotransplants.

ENHANCING LATENT FINGERPRINT DETECTION: INVESTIGATING THE PERFORMANCE OF THE FULL SPECTRUM IMAGING SYSTEM

JINNAH PARRISH
STUDENT PRESENTER

DR. ANNA DUGGAR
RESEARCH ADVISOR

Fingerprints are essential in criminal investigations and are a cornerstone of personal identification. Latent prints are created when oils, sweat, or contaminants are transferred onto a surface, leaving an impression of the fingerprint; these latent prints remain invisible to the naked eye without using physical or chemical methods to reveal the print residue. The FSIS (Full Spectrum Imaging System) offers a modern solution to many limitations of traditional latent fingerprint visualization techniques. This instrument employs reflected ultraviolet imaging (notably UV-C) and electronically enhanced fluorescence and absorbance images generated using electromagnetic energy ranging from 254 to 1100 nm to capture latent prints for investigative purposes.

This presentation examines the results of a series of evaluations of the FSIS's visualization capacity. Various substrates were evaluated, including porcine skin (as a substitute for human skin) and cartridge casings as surfaces for visualizing latent prints, experimental prints made in mock eccrine solution, and prints in blood. Qualitative and, when possible, quantitative results will be discussed, including comparison results of visualization with and without the FSIS over time or after exposure to harsh environmental conditions.

MODELLING HYSTERETIC CONDUCTANCE TO EXTRAPOLATE SHAKER POTASSIUM ION CHANNEL GATING BEHAVIOR

OWEN TAYLOR
STUDENT PRESENTER

DRS. ARMIN KARGOL & ANAT BURGER
RESEARCH ADVISORS

Hysteresis, “deficiency” or “lagging behind,” from the Greek hustérēsis, is the delayed response of some output signal moving in tandem with a variable input signal. In potassium ion channels, hysteresis is observed in the relationship between voltage (V) and current (I). The present research entails applying oscillatory voltage to a transfected HEK293, tsA201 cell which over-expresses mutant Shaker Potassium ion channels in a technique known as patch clamping. The output is read as a current value which varies with the applied voltage. From the relationship between applied voltage and measured current, so-called conductance loops can be constructed which depict the hysteretic behavior of potassium ion channel conductance. From these conductance loops, as well as other I:V relationships, the kinetics and state-based dynamics of the transmembrane protein can be studied, modeled, and elucidated. A hidden Markov process behind channel gating is assumed, the parameter coefficients of which are solved for from experimental patch clamping data. The physiology of the tetrameric channel has historically been exploited to circumvent Baum-Welch-based approaches to Markov chain construction. Herein, six proposed Markov models from the literature which consulted the physiology of the channel are assessed for their capacity to replicate experimental data. Ultimately, the comparison of experimental data to predictions made by the various Markov models has set a path for the computational deduction of gating characteristics in the Shaker Potassium ion channel.

CORRELATION BETWEEN ALKALI METAL ACETATE PRECIPATATING SALTS AND LIGAND CAPPED GOLD NANOCLUSTERS

ELYSSE JUNE
STUDENT PRESENTER

DR. CHRISTINE HEINECKE
RESEARCH ADVISOR

The ability to control size and shape of nanomaterials is vital to their numerous applications. Para-mercaptobenzoic acid is thiolate ligand with the ability to stabilize atomically precise water-soluble nanoclusters: Au_{102}(p-MBA)$_{44}$ and Au_{144}(p-MBA)$_{60}$. In order to manage the size, shape, and yield of nanomaterials capped with p-MBA, we explored the role of precipitating alkali metal acetates in solution. We have found a direct correlation between the size of alkali metal acetate precipitants and the size of nanocluster products.

SYNTHESIS AND CHARACTERIZATION OF ORGANOMETALLIC COMPLEXES VIA SPECTROSCOPIC TECHNIQUES FOR MATERIAL DESIGN

ANDRE HOYUELA
STUDENT PRESENTER

DR. SHANE McGLYNN
RESEARCH ADVISOR

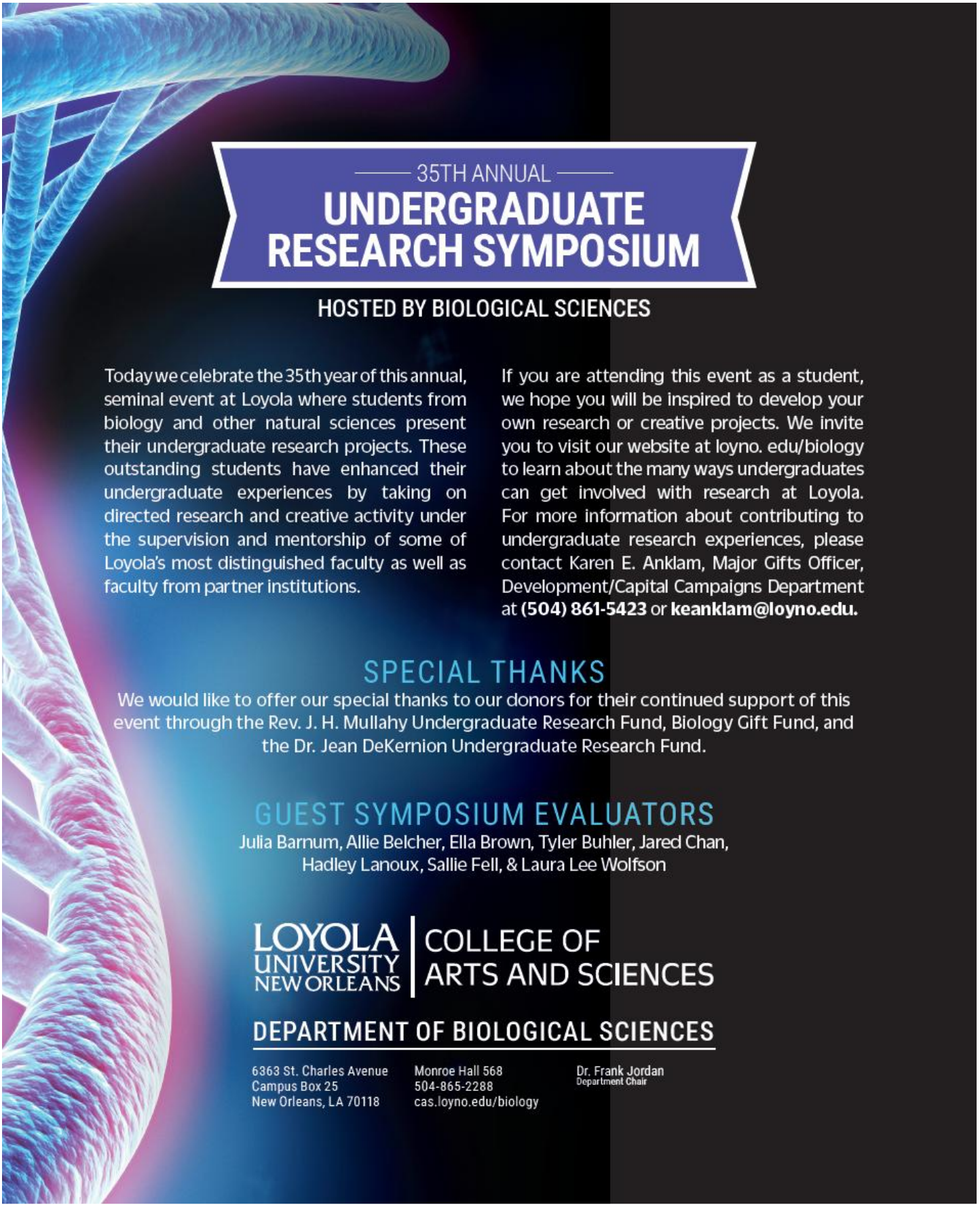
The future of material development and design starts with understanding the radiation absorption and emission properties of molecular complexes. Material tunability can be achieved through a wide range of chemical and physical alterations that allow for an extremely diverse array of electromagnetic responses. An attempt to achieve material tunability was conducted by developing novel organometallic/radiation absorption complexes via synthetic ligand strategies. Organometallic complexes consist of a metal that is located at the center of the complex and organic compounds called ligands that surround the metal. Absorption and emission properties of a series of substituted six-coordinate organometallic Tungsten complexes were studied across the ultraviolet to infrared wavelength regions. Upon extensive analysis via spectroscopic techniques, it was concluded that the electromagnetic responses of the complexes were significantly affected by the ligand architecture surrounding the chromium central atom. Material tunability was achieved through the chemical and physical properties outlined in this study.

SEARCHING FOR SYNERGISTIC ANTIMICROBIAL ACTIVITY BETWEEN SILVER NANOPARTICLES AND TOXIC IONS

DELANEY MATHIS
STUDENT PRESENTER

DR. WILLIAM WALKENHORST
RESEARCH ADVISOR

The increased need for new antimicrobials in medicine is an urgent issue due to the growing numbers of antibiotic resistant bacteria in the last few years. Combination therapy using silver nanoparticles (AgNPs) and toxic metal ions is a potential treatment for nosocomial infections acquired from antibiotic resistant bacteria. Both AgNPs and toxic metal ions are reported to be effective antimicrobials, and our research has shown that toxic metal ions exhibit synergy with antimicrobial peptides (AMPS). In this study, synergy assays were conducted to determine if AgNPs and toxic metal ions such as Cu^{2+}, Zn^{2+}, and Ag^{+} are more effective against various bacteria when combined with each other than by themselves. We hypothesized, based on prior synergy studies with AMPs, that AgNPs combined with Cu^{2+}, Zn^{2+}, and Ag^{+} have the potential to exhibit synergistic antimicrobial activity. AgNPs with Ag^{+} showed synergy when used against *Staphylococcus aureus*, and AgNPs with Cu^{2+} showed synergy when used against *Burkholderia thailandensis.*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Today we celebrate the 35th year of this annual, seminal event at Loyola where students from biology and other natural sciences present their undergraduate research projects. These outstanding students 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 as well as faculty from partner institutions.
If you are attending this event as a student, we hope you will 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 at Loyola. For more information about contributing to undergraduate research experiences, please contact Karen E. Anklam, Major Gifts Officer, Development/Capital Campaigns Department at (504) 861-5423 or keanklam@loyno.edu.
SPECIAL THANKS
We would like to offer our special thanks to our donors for their continued support of this event through the Rev. J. H. Mullahy Undergraduate Research Fund, Biology Gift Fund, and the Dr. Jean DeKernion Undergraduate Research Fund.
GUEST SYMPOSIUM EVALUATORS
Julia Barnum, Allie Belcher, Ella Brown, Tyler Buhler, Jared Chan, Hadley Lanoux, Sallie Fell, & Laura Lee Wolfson
LOYOLA UNIVERSITY NEW ORLEANS
COLLEGE OF ARTS AND SCIENCES
DEPARTMENT OF BIOLOGICAL SCIENCES
6363 St. Charles Avenue
Campus Box 25
New Orleans, LA 70118
Monroe Hall 568
504-865-2288
cas.loyno.edu/biology
Dr. Frank Jordan
Department Chair