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LUMCON's Research Experience for Undergraduates (REU) Program: *Interdisciplinary Research Experiences in Louisiana's Changing Coastal Environments*

2022 LUMCON REU Mentors and Project Opportunities

Mentors and mentor teams will be selected from LUMCON faculty members, their post-docs and graduate students, and visiting scientists who have active research programs addressing basic and applied research questions in and around the Mississippi and Atchafalaya Rivers, their deltas, adjacent wetlands, and nearby shallow coastal or deep ocean waters.

In the summer 2022, REU opportunities are available in several research areas, including:

- ecosystem ecology and biogeochemistry
- habitat forming species
- dissolved organic matter cycling
- microbial ecology and diversity
- coastal geology and sea level rise
- invertebrate richness and diversity in coastal habitats
- wetland ecology
- disturbance ecology

The following mentors at LUMCON are accepting students for the 2022 LUMCON REU program (this list will change yearly).

Dr. Brian Roberts is an ecosystem ecologist and biogeochemist. His research group studies how ecosystems along the freshwater-estuary-ocean continuum process and retain nutrients and energy and how this is altered as a result of human perturbations to the landscape. His research interests also include biogeochemical cycling, microbial ecology, plant ecology, and predator-prey interactions in wetlands and estuarine pelagic and benthic environments and involves field observations and controlled mechanistic experiments conducted both in field and laboratory settings. Dr. Roberts is interested in mentoring REU students with interests in working with a team of researchers to develop independent projects that fit within the context of our group's diverse, larger efforts. *Some potential research projects include: wetland biogeochemistry; marsh plant ecology; controls on denitrification vs. dissimilatory nitrate reduction to ammonium (DNRA) rates; oil impacts on plants as well as microbial communities and N-cycling rates in marsh soils; marsh predator-prey interactions; the role of mussels and/or oysters in living shorelines; disturbance impacts on sand shoal ecosystem*s.

Dr. Stephanie Archer is an ecologist with a research program focused on elucidating the role that habitat forming species (e.g. sponges, oysters) play in maintaining biodiversity and ecosystem function in the Anthropocene. Specifically, the Archer lab is interested in determining how habitat forming species regulate energy flow and nutrient cycling in ecosystems and what happens to these processes when habitat forming species are impacted by human activities. To address these

questions we use a variety of approaches including natural history, food web ecology, passive acoustics, and analytical chemistry. Our work spans from inland waterways to the deep sea and from the Gulf of Mexico to the Northeastern Pacific. Dr. Archer is interested in mentoring REU students interested in oyster reef or rocky reef ecology. *Potential projects include identifying acoustic indicators of biodiversity in either oyster or rocky reef habitats, examining the impacts of environmental conditions on oyster feeding behavior, or comparing sampling methods for sampling reef-associated biodiversity*.

Dr. Marshall Bowles investigates the microbiology and geochemistry of salt marsh and deep sea environments. The ocean has a great abundance of microbes (e.g. bacteria), indeed they outnumber humans by much more than a million times! We know microbes, though small, change how chemical elements move on Earth. My goal is to understand how microbes in the coast and the ocean interact with the world around them. This means that I typically try to figure out how microbes actually change the chemistry in their environment or are themselves influenced by the chemical environment around them. REU projects in Dr. Bowles' lab will be field and lab based and utilize a variety of microbiological analytical tools, as well as analytical chemistry equipment. *This summer we are looking for students interested in: exploring microbial diversity in salt marsh sediments; describing nutrient fluxes, particular nitrogen fluxes in salt marsh sediments; describing plant microbe interactions.*

Dr. Juliana D'Andrilli is a carbon cycling biogeochemist. Her research team studies carbon cycling from the perspective of dissolved organic matter (DOM) evolution in marine, freshwater, terrestrial, and cryosphere ecosystems. Dr. D'Andrilli is interested in the amount and type of carbon-based materials (or chemical energy; DOM) that are being produced in rivers, soils, and marine waters, as well as currently being stored in glaciers so we can predict its impact in the future. At the bulk and molecular-level, DOM composition and character reflect biogeochemical flux and cycling; therefore, identifying its chemical signatures may inform understanding of spatial and temporal patterns throughout aquatic and terrestrial networks. *Dr. D'Andrilli is interested in mentoring REU students on research projects that involve determining DOM qualitative signatures (absorbance and fluorescence) of marshland coastal environments, its reactivity, its concentration, and what materials are cycled among biological and photochemical degradation mechanisms that transform the DOM. These types of projects involve field work to collect samples, analytical chemistry techniques, laboratory incubation experimental design, experiment management, and data processing*.

Dr. Alex Kolker investigates the physical and geological processes that govern coastal systems. Sea level is one of the dominant controls on coastal systems. And while scientists recognize that sea level is rising over the long-term as a result of climate change (and in Louisiana subsidence), on shorter time scales the drivers of water level fluctuations are less well understood. *This project will examine the controls on sea level fluctuations in the northern Gulf of Mexico, and in particular how seasonal winds, cold fronts, and tropical cyclones impact water levels. The project will combine field measurements of local water levels and local geomorphological features with large-scale data analyses.* Students who are interested in geological and physical process, and students with an aptitude for data analysis are encouraged to apply.

Dr. Craig McClain and his deep-sea and ecology lab study diversity and ecology of various habitats unique to the Gulf of Mexico as part of a ground-breaking research on both the deep oceans and coastal bays. Opportunities exists to investigate the amazing invertebrate biodiversity of salty underworld to help gain a better understanding of how climate change will impact biological communities. REU interns will participate in the sorting, identification, and enumeration of invertebrates to examine ecological structure shallow and deep Gulf of Mexico. *One potential project*

is related to deep-sea wood falls. In May of 2017 over 200 wood packages were deployed in the deep (2,000 meters) Gulf of Mexico in an experiment to examine how food availability determines ecological dynamics. A second potential project is related to ongoing monitoring of Terrebonne Bay examining the role of hurricanes and other disturbances on benthic invertebrates. Both projects include microscope work identifying invertebrates and statistical analyses. A background with invertebrates as well as R-package is preferred. Students should plan to work both in the lab and within the bays, bayous, and barrier islands of southern Louisiana with frequent boat trips to sampling locations.

Dr. Guillaume Rieucau is a Marine and Coastal Behavioral Ecologist studying the role of behavior in structuring fish communities and trophic interactions in marine and estuarine ecosystems. He is interested in understanding the fundamental processes that mediate predator-prey interactions, habitat use and aggregative tendencies of fish in a fluctuating environment. He explores how schools (from forage fish to piscivorous species) collectively react to external factors such as predators, environmental conditions, anthropogenic disturbances, fishery activities and habitat structure. He addresses most of these questions by conducting laboratory, mesocosm and in situ behavioral experimentations using advanced technology (high resolution imaging sonar, unmanned aerial vehicles) and multi-target computer tracking, video analysis to quantify fine-scale dynamic behavioral responses. He is also using his experience in animal behavior to provide information for conservation and management plans. *Potential REU research projects include: 1) Effects of underwater noise on anti-predatory responses of free-ranging schooling fish in salt marshes, 2) Exploring how schooling provide hydrodynamic benefits and security advantages in salt marsh fish species.*