UNIVERSITY OF SOUTH FLORIDA
COLLEGE OF MARINE SCIENCE

Research Abstract
Marine Microbiology and Genomics
Mya Breitbart

http://www.marine.usf.edu/genomics

In every milliliter of surface seawater, there are 1 million bacteria and 10 million viruses. These microbes are extremely diverse, and play important roles in global carbon and nutrient cycling. The Breitbart lab uses molecular techniques (such as metagenomic sequencing) to examine the diversity, distribution, and ecological roles of viruses and bacteria in a wide range of environments - including seawater, marine animals, coral reefs, acid mine drainage sites, sewage, and reclaimed water. Current projects in the Breitbart laboratory include:

- Identification of Novel Pathogenic Viruses from Marine Animals (sea turtles, sea lions, etc…)
- Coral-associated Microbial Communities During Coral Restoration in the Florida Keys
- Viruses in Raw Sewage and Their Ability to Indicate Fecal Pollution in Coastal Waters
- Microbial Communities Associated with Carbonate Biomineralization in Modern Freshwater Microbialites
- Abundance, Dynamics, and Diversity of Viruses in the Northwestern Sargasso Sea
- Potential of Reclaimed Water to Serve as a Mechanism for the Dissemination of Viruses
- Development of Proteogenomic Approaches in Acid Mine Drainage Systems to Analyze the Role of Virus-Microbe Interactions in Shaping Natural Microbial Communities

Research in the Breitbart lab is critical for understanding the basis of ecosystem function, and has implications for public health and protecting the health of the environment. These projects involve collaborators within the University of South Florida, as well as at the Florida Aquarium, Mote Marine Laboratory, the United States Geological Survey, All Children's Hospital, the University of Florida, the University of Central Florida, and the United States Department of Agriculture. In addition, national and international partners include the Kansas City Zoo, Oak Ridge National Laboratory, the University of California, Berkeley, Rice University, San Diego State University, the National Autonomous University of Mexico, the Bermuda Institute of Ocean Sciences, and the Genome Institute of Singapore.

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Research Abstract

PAMELA HALLOCK MULLER, PH. D., PROFESSOR
Phone: 727-553-1567; FAX: 727-553-1189
e-mail: pmuller@marine.usf.edu; website: www.marine.usf.edu/reefslab

Research Interests
By studying the geologic record and modern coral reefs and other coastal benthic communities, my students and I gain insight not only into environments of the past and present, but also the potential effects of human activities on the future of Earth's ecosystems. Our work has implications for cell biology, coral reef ecology, environmental management, global environmental change, evolution, paleoceanography, sedimentology, and hydrocarbon exploration.

Ongoing or recent projects include:
a) Decadal-scale changes in reef communities in the Florida reef tract
b) Bleaching in reef-dwelling foraminifera as an indicator of photo-oxidative stress on reefs
c) Development of indices of biological integrity applicable to mid to low latitude coastal environments worldwide
d) The role of atmospheric carbon dioxide in calcification and reef-building communities
e) Impact of potentially toxic elements (aka heavy metals) on benthic foraminifers
f) Benthic communities and carbonate sedimentation on the west Florida shelf

Future directions:
I have current projects involving bioindicators and pollution impacts. A future direction for that research could be to develop biomarkers based on gene expression that would further the application of foraminifers in assessing stressors in reef and coastal environments. I have recently established collaborations with Dr. Byrne of CMS, Dr. Lisa Robbins of the USGS, and Dr. Chris Martens of the University of North Carolina – Chapel Hill, to pursue research on the effects of ocean acidification on Florida shelf and reef communities.

Career Summary
1970's - Became an established researcher on larger foraminifers, including their sediment contributions to modern coastal systems and their use in interpreting ancient limestones.
1980's - Recognized that nutrient pollution is a key threat to coral reefs and communicated to scientists, environmental agencies, and coastal management of possible consequences.
1990's - Discovered bleaching in reef-dwelling foraminifers, and communicated to scientists, environmental agencies, and coastal management the wider implications.
Present - Actively engaged in research to assess human impact on coral reefs and other coastal/shelf benthic communities, including effects of anthropogenic nutrients, heavy metals, ocean acidification and stratospheric ozone depletion.
More than 100 scholarly papers published in scientific journals and books; thesis/dissertation advisor to >40 students; committee member for >50 others.

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Research Abstract

Seafloor Imaging and Benthic Habitat Mapping of the Coastal Ocean

Albert C. Hine and Stanley D. Locker

For the past 29 years here at USF, we have used a combination of geoacoustic (side-scan sonar, seismic reflection, swath imaging, etc.) remote sensing and ground-truthing (coring, bottom photography, rock dredging, etc.) techniques to understand the geologic history and character of the seafloor underlying the coastal ocean (estuaries, coastal zone, continental shelf, upper slope). This work was done to understand basic problems such as the timing, amplitude, and rate of sea-level fluctuations and how those fluctuations shaped the continental margin, the distribution and movement of sediment, and how the geology controls the distribution of life on the seabed. Additionally, we were able to locate important mineral resources such as sand for the beaches and phosphate for possible underwater mining. In the early to mid 1990's, we conducted a detailed geologic reconnaissance survey of a large section of the inner shelf from Anclote Key to Venice Beach (USGS funded—see http://coastal.er.usgs.gov/wfla/ for map products and 2003 *Marine Geology Special Volume* for scientific interpretation). This led to a significantly-elevated understanding of the geology of the seafloor and seafloor dynamics off this portion of Florida's Gulf of Mexico coastline. Numerous products were generated for use by beginning students and seasoned coastal managers. Research funded by ONR led to a focused analysis of sediment movement and seabed geology impacting mine burial. More recently, our work led to the discovery of the deepest, light-dependent coral reef on the US continental shelf (Pulley Ridge 65-90 m water depth—now declared a Marine Protected Area by NOAA), to discovery of an ancient lake bed lying beneath Tampa Bay that has significant archeological/climatological implications as well as a theory on the origin of Tampa Bay that could affect groundwater hydrologic models.

Armed with our significant array of new seabed-imaging tools and access to very high end ROV's, we are poised to provide not only seafloor imagery, but maps of benthic habitats based upon the ground-truthing through direct observations. These observations and measurements will allow us to calibrate quantitatively and classify the geology/biology of the seafloor and present these classifications on meaningful habitat maps. And, these tools will allow us to provide information about the seafloor at very high resolution (centimeter to meter scale).

The task of mapping the entire seafloor of our estuaries, coastal bays, and continental shelf is enormously complex logistically, poses huge data-management challenges and is prohibitively expensive at the moment. So, strategies such as choosing selected targeted areas that have indicated importance to living resources for focused analysis or completing widely-spaced depth transects from shore to the upper slope, for example, will provide a starting point. But, to understand and manage the living and non-living resources that the seabed of the coastal ocean provide will require a significant and long-term commitment to high-tech mapping and appropriate interpretation. Finally, through evolving techniques of seascape modeling, we hope to predict seabed changes on decadal time scales. We in the College of Marine Science at USF are poised and appropriately-positioned to play a leading role in such an undertaking.

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Research Abstract
Joseph J. (Jose) Torres

I have two current primary research interests. Both deal with topics of global concern. The first is the influence of hypoxia, or low oxygen concentrations, on the distribution and metabolism of oceanic fauna. In the open ocean, oxygen minimum zones have always been present at particular locations around the globe, for example, off the west coast of North and Central America. Animals that dwell in oxygen minima are equipped to deal with them. The question is how, and what special characteristics do they have to enable survival in areas with no, or very low, oxygen. I am using the Cariaco Basin off Venezuela as a model system to investigate how resident animals deal with the severe oxygen minimum (zero oxygen with hydrogen sulfide present) there.

The second area of current research is in the area of global climate change, using one of the most rapidly warming areas on the planet as a model system: the Antarctic Peninsula. Evidence collected on penguin diets over the last 25 years strongly suggests that the most important Antarctic coastal fish has disappeared over a large part of its former range on the peninsula. We will find out if this is indeed the case, and hopefully, what stage in the species' life history makes it particularly vulnerable.

Both projects fall into the large area of basic research. Both have applicability to more local systems and problems. "Dead zones" or hypoxic regions are becoming a global problem. The Gulf of Mexico has one of the world's largest at the mouth of the Mississippi. At what concentration does low oxygen become limiting to most species? How long must zones of hypoxia persist to be lethal? What animal groups are most and least resistant? Are some animal groups "pre-adapted" to survive hypoxia? For response to climate change, is its greatest influence change in habitat quality, seasonal perturbation, or direct effects of temperature?

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Research Abstract
Marine Organic Chemistry
Ted VanVleet, Ph.D

For the past 29 years at USF, my research has focused on marine organic chemistry, and in particular on the analysis of organic compounds at the molecular level. We have used naturally produced and anthropogenically introduced organic molecules to investigate a variety of different processes occuring in the ocean. Among the projects carried out in the past, we have examined the overwintering strategies of Antarctic organisms; paleo-reconstruction and chemical ecology using archaebacterial lipids in anoxic and hypersaline oceanic systems; inputs, dispersal and accumulation of terrestrial and urban runoff; and inputs fates and effects of oil pollution in the marine environment. For the past 20 years, we have also been involved in a variety of studies in the canals and lagoon of Venice, Italy. The most recent work has been related to mass balance fluxes of organic material between the Northern Adriatic Sea and the Lagoon of Venice.

Future research in our laboratory will be taking several major directions. First, we are currently involved in two new projects dealing with bioactive compounds and toxins. One project examines environmental effects on the production of toxins by marine dinoflagellates (including brevetoxin and saxitoxin). A second project investigates the accumulation and potential effects of endocrine disruptors on marine organisms. In addition, we are also becoming more involved with interfacing our molecular organic approach with the compound specific stable isotope analysis of carbon, hydrogen, and nitrogen in marine environments. Combining these types of studies can provide entirely new insights into the origin and cycling of organic matter in the marine environment.