2012
Summer Research Academy Symposium

Friday, August 3, 2012
9:00 am
J. Bennett Johnston
Health and Environmental Research Building
Room 111A

Sponsored by:

National Science Foundation
and
Gulf of Mexico Research Initiative

EDEB 2012 INTERNS

CMEDS 2012 INTERNS

Programme

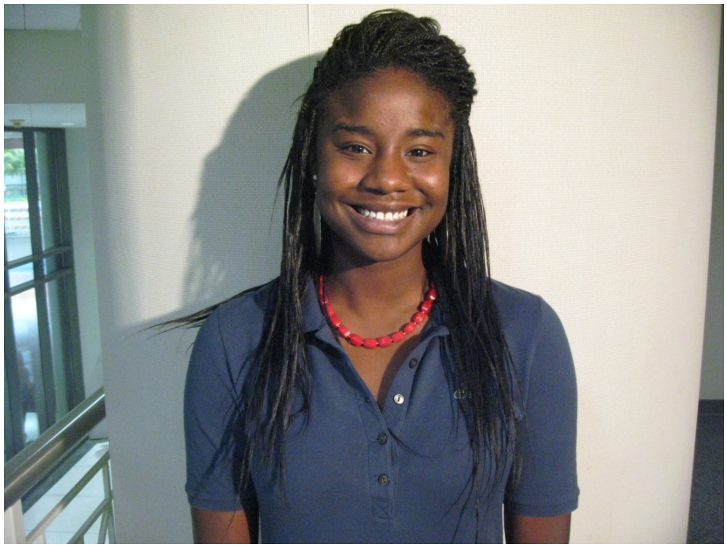
9:00 am	**Opening Remarks**	

Oral Presentations

	Presenter(s)	**Mentor (s)**
9:05 am	**Diari Gilliam**	**Lyndsay Rhodes, PhD**
9:25 am	**Brian Bloom-Peltz**	**Vijay John, PhD**
9:45 am	**Jeremiah Jackson**	**Michael Blum, PhD**
10:05 am	**Sinead Holleran**	**Hank Ashbaugh, PhD and Lawrence Pratt, PhD**
10:25 am	**Maya Patterson**	**Hank Bart, PhD**
10:45 am	**Julie Kaiga and Rebecca Tamayo**	**Vijay John, PhD**
11:05 am	**Break**	
11:15 am	**Tammy Vo**	**Cori Richards-Zawaski, PhD**
11:35 am	**Ta'Ryan Lloyd**	**Louis Thibodeaux, PhD**
11:55 am	**Karry Wright**	**Florastina Payton-Stewart, PhD**
12:15 pm	**Elise Mills**	**Kyriakos Papadopoulos, PhD**
12:35 pm	**Aurielle Modster and Melanie Sebastian**	**Noshir Pesika, PhD**
12:55 pm	**Steven Nguyen**	**Louis Thibodeaux, PhD**
	Tyler Nesmith	**Krishnaswamy Nandakumar, PhD**
	Nick Altiero	**Hank Ashbaugh, PhD and Lawrence Pratt, PhD**

There will be a reception immediately following the oral presentations.

-All are invited-



The HDAC Inhibitor Panobinostat Inhibits the Migration and Invasion of Triple-Negative Breast Cancer *in vitro.*

Diari N. Gilliam[1], Lyndsay V. Rhodes[2], Matthew E. Burow[2], and Bridgette Collins-Burow[2]
[1]Xavier University, Department of Biology, New Orleans, LA
[2]Tulane University School of Medicine, Department of Hematology and Medical Oncology, New Orleans, LA

Introduction

Triple negative breast cancer (TNBC), negative for estrogen (ER), progesterone (PR) and Her2/neu receptors, represents approximately fifteen percent of all breast cancer diagnoses. It is notorious for having higher prevalence in African-American women and frequent incidence in younger patients. TNBC is also characterized as a more aggressive phenotype with a high rate of metastasis that is facilitated by its mesenchymal morphology. Because EMT (epithelial-to-mesenchymal transition) of TNBC cells contributes to rapid metastasis, a potential therapy of TNBC could be to inhibit this morphological transition. Epigenetic alterations, such as modification of histones and proteins by acetylation and/or phosphorylation, play critical roles in the control of gene regulation. HDAC inhibitors (HDACi) prevent the deacetylation of histones by HDACs which in turn alters gene expression. Our previous results demonstrated the ability of the pan-HDACi, Panobinostat (LBH589), to inhibit TNBC survival *in vitro* and tumorigenesis *in vivo.* Additionally, LBH589 induces the expression of the epithelial cell marker E-cadherin and alters cell morphology in a manner indicative of EMT reversal. As EMT has been shown to contribute to cell motility and invasiveness, key components of metastasis, these results led us to test the hypothesis that LBH589 inhibits the migration and invasion of TNBC cells.

Methods

Migration and invasion assays (BD Falcon) were conducted following manufacturing instructions to determine the effects of LBH589 on cell motility and invasion *in vitro.*

Results

LBH589 significantly inhibited the migration of TNBC cells (MDA-MB-231 and Bt-549) more than 60% compared to vehicle treated cells. Migration of the ER-positive breast cancer cell line MCF-7 was also inhibited by to a lesser extent. TNBC cell invasion was also inhibited by LBH589 treatment in the TNBC cell lines compared to vehicle treated cells.

Conclusion

The HDACi LBH589 inhibits cell migration and invasion *in vitro* – two key components of the metastatic process in TNBC cell lines MDA-MB-231 and Bt-549, and may be a novel potential therapeutic for the treatment of this highly metastatic disease.

Synthesis and Characterization of Ultra-thin Shell Hollow Silica Microspheres for Pickering Emulsions of Oil in Water.

Brian Broom-Peltz, Yingqing Wang, Pradeep Venkataraman, and Dr. Vijay John
Tulane University, Department of Chemical and Biochemical Engineering, New Orleans, LA

Ultra-thin shell hollow silica microspheres were synthesized using a simple aerosol based process. The hollow silica particles were in the size range 100-2000 nm and had shell thickness of 10-20 nm. The interfacial behavior of these particles at oil-water interface was investigated with the objective of using them in surfactant-free stabilization of oil droplets in water. We hypothesize that the particles will adsorb at the oil-water interface and stabilize droplets of oil by reducing the oil-water interfacial tension and by creating a steric barrier to coalescence. We study these particles for potential application in oil spill remediation due to their interfacial activity and their ability to stay afloat on the surface of water. We anticipate the possibility of loading the hollow silica microspheres with nutrients or dispersants to deliver the active components at the oil-water interface to facilitate biodegradation.

Reconstructing Seed Bank Profiles for *Schoenoplectus americanus* in North Carolina Brackish Marshes.

Jeremiah D. Jackson[1], Elizabeth R. Jarrell, MS[2], Cassandra Campbell[2], and Dr. Michael Blum[2]
[1]Xavier University, Department of Biology, New Orleans, LA
[2]Tulane University, Department of Ecology and Evolutionary Biology, New Orleans, LA

Characterization of dormant propagule pools has proven to be a highly effective approach for reconstructing records of ecological and evolutionary responses of natural populations to contemporary environmental change. Few attempts have been made, however, to reconstruct historical records of genetic change or evolutionary responses of plants to environmental change from time-stratified soil-stored seed banks. Here we present a study of time-stratified soil-stored seed banks of the C_3 sedge *Schoenoplectus americanus* from Pamlico Sound (North Carolina), which is a region of the Atlantic coast that is experiencing a high rate of relative sea level rise. We analyzed twenty 50 cm soil cores taken from two brackish marshes. Each core was first sectioned into 25 layers in 2 cm intervals. Sections from one exemplar core were dated using radiometric analysis (210 Pb), which indicated that soil depths from 0 to 14 cm spanned approximately 92 years of stratigraphic history. All of the soil core sections were subsequently screened for *S. americanus* seeds using a 1mm sieve, and all recovered seeds were subjected to germination trials to assess viability for reconstructing experimental populations. Lastly, we extracted DNA from recovered seeds to assess viability for reconstructing temporal records of genetic variation. The cores contained between 0 and 28 seeds, with a mean of 13.8 seeds per core. Seeds in the 2-4 cm section of the cores accounted for 26% of the total count. Germination rates varied between 0% (8-10 cm, n = 2) and 100% (20-22 cm, n = 1), with the overall germination rate was 48.78% (n = 41). Seeds recovered to depths of 24 cm were successfully germinated. Recovered DNA concentrations ranged from 0.08 to 7.20 ng / microliter, with concentrations averaging 4.1 ng / microliter. The recovered DNA from nearly all of the seeds resulted in successful PCR amplifications of a conserved chloroplast gene region. This step-wise approach enabled us to to illustrate that, like other better studied dormant propagule pools (e.g., zooplankton resting egg banks), soil-stored seed banks are promising resources for studying adaptive evolution to contemporary environmental change.

Primitive Hydrophobic Interactions from Analysis of Spontaneous Formation of Atomic-Scale Cavities In Liquid Water.

Sinead Holleran, M. I. Chaudhari, Dr. Henry S. Ashbaugh, and Dr. Lawrence R. Pratt
Tulane University, Department of Chemical and Biochemical Engineering, New Orleans, LA

Potentials-of-mean-force (pmfs) between pairs of hard-sphere solutes in water can be obtained from the radial distribution of atomic-scale cavities that spontaneously form in liquid water. Pmfs are the proper atomic-scale definition of hydrophobic interactions. We have carried-out the required cavity analysis on the basis of readily available molecular simulation data. These results (below) provide the first direct point-wise test of the most significant prediction of the Pratt-Chandler (PC) theory. For the case of hard-sphere solutes which correspond to the size of Ar (argon) atom pairs, the prediction of the PC theory is only qualitatively correct, not quantitatively accurate in important respects. The implied osmotic second virial coefficient should reflect stronger hydrophobic attractions than is predicted by the PC theory. These results resolve arguments on the accuracy of PC theory, which have been previously inconclusive for decades. Accurate results for these hard-sphere pmfs are essential for extending our understanding of hydrophobic interactions to include precise assessments of the effects of attractive dispersion interactions, and changes that are anticipated for much larger-sized solutes.

Fish and Invertebrate Diversity and Water Quality in the Tana River System, Kenya.

Maya Patterson[1], Ray Schmidt[2], and Dr. Henry Bart[2]
[1]Xavier University, Department of Biology, New Orleans, LA
[2]Tulane University, Department of Ecology and Evolutionary Biology, New Orleans, LA

During the 2011-12 academic year, I worked in the laboratory of Dr. Henry Bart of the Department of Ecology and Evolutionary Biology under the guidance of graduated student, Ray Schmidt with support from the Tulane-Xavier Enhancing Diversity in Environmental Biology (EDEB) program. In Summer 2012, I traveled to Kenya as part of 2012 cohort of students participating in the NSF International Research Experiences for Students (IRES) project led by Dr. Bart. The aim of the IRES project is to overcome barriers to international collaboration for biology students at Tulane University and nearby historically Black universities (HBCUs) in New Orleans through a program of cultural training and collaborative fish biodiversity research in Kenya. This presentation is group summary of sampling of small streams in the Tana River system by the 2012 IRES team. We sampled five rivers, River Murera, Bwatherongi River, River Rojewero, River Ura and River Ragatti. Four of the rivers are within or very close to Meru National Park. At each site, we collected fishes, invertebrates, physical characteristics of each of the streams, and water quality using monofilaments gill nets, dip nets, electro fisher with a seine net, a water probe and a flow meter. Fish and invertebrate diversity was related to streams conditions and water quality. Rivera Murera had the most fish and the highest fish diversity, River Ragati had the most invertebrate diversity. Further analysis of water quality and stream conditions is warranted, and the results will be compared to results based on similar sampling of streams in two other river systems of central Kenya: the Ewaso Nyiro and the Athi.


Microbes Eat Gulf Oil Spill: Electron Micrographs of Indigenous Oil-Degrading Bacteria at the Oil-water Interface.

Julie Kaiga[1], Rebecca Tamayo[2], Olasehinde Owoseni[3], and Dr. Vijay John[3]
[1]Tulane University, Department of Biomedical Engineering, New Orleans, LA
[2]Tulane University, Department of Public Health, New Orleans, LA
[3]Tulane University, Department of Chemical and Biomolecular Engineering, New Orleans, LA

In combination with other oil spill clean-up methods, microorganisms in marine ecosystems are known to have predominant roles in the degradation of oil contaminants. It is expected that indigenous microbial communities have a significant role in degradation of deep-sea oil plumes. Through this investigation the study will look at how the bacteria adsorb at the oil-water interface to biodegrade spilled oil with the presence of surfactant molecules (COREXIT). The oil-degrading bacteria employed in this study are *Oleispirea antarctica* and *Oceaniserpentilla haliotis*. A mixture of crude oil and Corexit 9500A (dispersant to oil volume ratio 1:100) is added to the vial containing bacteria and saline water. The oil to water volume ratio was 1:100. Emulsions are prepared by stirring the contents of the vial on a vortex mixer for 1 minute at 3000rpm. The emulsion formed is imaged using a Cryo-Scanning Electron Microscope. Cryo-Scanning Electron Microscopy (Cryo-SEM) will show the bacteria at the oil-water interface. The results will assist in constructing a model Gulf of Mexico microbial community, to visualize if/how bacteria adsorbed at the oil-water interface in the presence of surfactant molecules (COREXIT).

The Effects of Temperature on Northern Cricket Frogs Infected with Chytridiomycosis.

Tammy Vo, Julia Sonn, and Dr. Cori Richards-Zawacki
Tulane University, Department of Ecology and Evolutionary Biology, New Orleans, LA

The main goal of the study is to determine how temperature affects the interaction between *Batrachochytrium dendrobatidis*, an amphibian fungal pathogen, and its hosts. This newly-emerged pathogen and the disease it causes (chytridiomycosis) have been responsible for declines and extinctions of numerous amphibian species. We exposed Northern Cricket Frogs (Acris crepitans) to this fungus then held them at three different temperatures to monitor the effects of temperature on disease progression. After the frogs were inoculated (by placing them in a solution containing zoospores of the fungus) we monitored the health of the frogs biweekly. Measurements of weight, body condition, corticosteroid levels (an indication of stress) and pathogen load, were compared between infected and control frogs across three temperature treatment groups. Due to an equipment malfunction, this experiment has not yet been finished. Further data will need to be collected this coming semester before we can draw any conclusions from the study.

Volatile Chemical Evaporation-produced Sinker Oil (EVAPO-SINKING) from Sea-surface Slick w/ wo Dispersant.

Ta' Ryan Lloyd and Dr. Louis Thibodeaux, Cain Department of Chemical Engineering, Louisiana State University, Baton Rouge, LA

The demand of oil is increasing the search for oil has resulted in deep water drilling becoming more prominent. Even though oil spills are a reoccurring event the recent BP spill has caused an ever-pressing issue of trying to find out exactly what happens to the oil after it has spilled. The most common type of oil spill happens in shallow water. The more risky drilling is deep water drilling and less information is available on the mass transfer that occurs during the dissolution process. There are two processes, which are evaporation (associated with shallow water spills) and dissolution (associated with deep water spills) because deep water drilling is fairly new there is limited information regarding the mass transfer of the materials. The objective of this research is to perform modeling and lab research to better understand the dissolution and evaporation process that causes the fallings of the heavies with and without dispersants.

When these processes occur the volatile and soluble material evaporate into the air and dissolve into the water creating heavies. Theses heavies have a density greater than seawater, and stay below the water's surface and may float in turbulence forever. Experimental oil containing benzene with a density of 0.8765 g/cm^3 and orthodicholrobenzene with a density of 1.3 g/cm^3 to make a density of a liquid that will float. Once the sample is spilled the time for the first and second drop is recorded and the density of each sample is recorded. Then using the flux equation we can solve for the partition coefficient. This same procedure is conducted for a binary mixture with the dispersant added. In the future there will be chemical analysis conducted to see if there is a difference in the composition of the original sample and the drop that include the heavies.

Synthesis of Berberine Analogs as Chemopreventive Agents for Triple Negative Breast Cancer.

Karry Wright, Dr. Subramanya Ravi Pingali, and Dr. Florastina Payton-Stewart
Xavier University. Department of Chemistry, New Orleans, LA

Breast Cancer is the most common cancer among women in the United States and is the second leading cause of cancer-related death in women. The American Cancer Society estimates that in 2012, 226,870 women in the US will be diagnosed with invasive breast cancer and 39,510 women will die from the disease during 2012. The National Cancer Institute recognizes that the incidence of BC is lower in African-American than in Caucasian-American women, yet breast cancer mortality rates are paradoxically higher for African-American women terming BC as a health disparity (2). The majority of diagnosed breast cancers are estrogen receptor (ER) positive providing a favorable target for endocrine therapy. Currently tamoxifen (TAM) is administered as first-line endocrine therapy and its development represents a major advancement in the treatment of ER positive breast carcinoma (1, 3-4). Despite the advances in endocrine therapy, an acquired resistance to endocrine therapy still remains a major obstacle in the treatment of breast cancer. Recent studies have found that the phytochemical, berberine, a benzyl-tetra isoquinoline alkaloid extracted from plants of the Berberidaceae family, has been extensively used for many centuries in traditional Chinese and Native American medicine. Several evidences suggest that berberine possesses several therapeutic uses, including antibacterial, antifungal, antipyretic, anti-inflammatory, anti-tumor, antidiabetic and anticancer activity. Herein, we investigate the structural activity relationship and anticancer activity of berberine on Triple-negative breast cancers (TNBC) Cell lines. We **hypothesize** that structural modifications of berberine may lead to effective anticancer agents used to address the serious health disparity observed among African American women, aided by Caucasian women with breast cancer and target signaling pathways. **METHODS:** The berberine analogs will be synthesized using traditional organic chemistry reactions and purified by recrystallization and Column Chromatography and analyzed using Thin Layer Chromatography (TLC), Nuclear Magnetic Resonance (NMR), and Liquid Chromatography- Mass Spectrometry (LC-MS). These analogs will be evaluated in various breast cancer cell lines using molecular biology assays such as colony assays, alamar blue assays, luciferase assays and western blotting. **CONCLUSION:** Preliminary data shows that berberine analogs could effectively be synthesized and are efficient at inhibiting the growth of Triple Negative Breast cancer cells. We conclude that these analogs may prove to be effective anticancer agents against Triple Negative Breast cancer.

BP-Oil-Spill Oil Transport in Porous Media via Packed-Bed Capillary Microscopy.

Elise Mills[1], Dr. Kyriakos Papadopoulos[2], Qing Wang[2], Peixi Zhu[2]
[1]Tulane University, Dept. of Earth and Environmental Sciences, New Orleans, LA
[2]Tulane University, Dept. of Chemical and Biomolecular Engineering, New Orleans, LA

In light of BP's Macondo well blowout in 2010, oil spill recovery research has accelerated in the past few years. While the oil has been rigorously cleaned from surface waters and beaches, contaminants still persist merely inches under the sand. Research of the behavior and movement of oil in porous media such as beach sand or marsh sediments is pertinent to the ongoing cleanup efforts of the Gulf Coast. For this reason, Dr. Papadopoulos's lab has focused on oil as well as bacterial transport in such porous media for possible *in-situ* bioremediation strategy development. Using packed-bed microcapillary video microscopy, both the transport of BP-oil-spill oil and *E. coli* bacteria were visually investigated. Using microcapillaries packed with cryolite particles (random porous media), non-wetting phase transport of oil was investigated with the focus on drainage displacement, a vital aspect in understanding the persistence of oil in sands. Additionally, the lab used microcapillary microscopy to investigate bacterial motility in confined spaces similar to pore size in sands. Investigating a phenomenon known as *steritaxis*, the fate of *E. coli* bacteria in tapered glass capillaries was recorded and visually studied. It was found that when in spaces of dimensions similar to the bacterial flagella, the bacteria exhibited *unidirectional motility*, explaining how bacteria can access contaminants in soil pores with dimensions comparable to their own. *Steritaxis* is a potentially controllable mechanism that can greater facilitate the access of flagellated bacteria to contaminants and contribute greatly to shoreline bioremediation.


Replicating Surface Chemistry and Topography of Marshland Grasses via Polymer Molding Techniques.

Aurielle Modster[1], Melaine Sebastian[2], and Dr. Noshir Pesika[3]
[1]Tulane University, Department of Environmental Biology, New Orleans, LA
[2]Tulane University, Department of Biochemistry, New Orleans, LA
[3]Tulane University, Department of Chemical and Biomolecular Engineering, New Orleans, LA

The goal of the present study is to accurately and efficiently create leaf mimics of natural marshland plants (*Spartina alterniflora*) with similar physical properties (i.e., surface energy and topography). To do this, a reverse structure (i.e., intermediate mold) of the live leaf samples was made by curing polydimethylsiloxane (PDMS) polymer on the natural leaf. The inverse PDMS mold was then treated with a monolayer of octadecyltricholosilane (OTS) thereby creating a non-sticky surface. PDMS was then cured over the treated inverse PDMS mold to create the final leaf mimic. Contact angle measurements of water and dodecane on the leaf mimics and the natural leaf were obtained and showed similar wetting properties. In addition, optical images confirmed that the macro- and micro-structures were preserved in the leaf mimics. The leaf mimics can potentially serve as a standard surface for future studies involving the coalescence of oil droplets (with and without dispersants) onto marshland plant surfaces.

Soluble Chemical Dissolution-Produced Sinker Oil (SOLUTE-SINKING) from Deep-Sea Spill w/wo Dispersant.

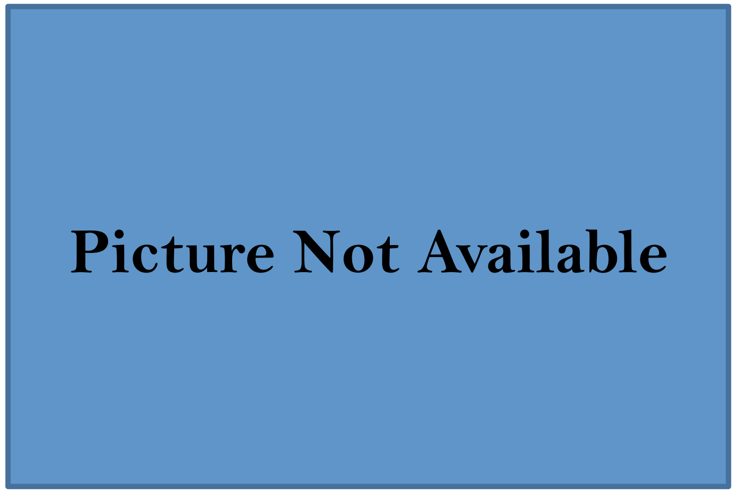
Steven Nguyen and Dr. Louis Thibodeaux, Cain Department of Chemical Engineering, Louisiana State University, Baton Rouge, LA

The exploitation of deep-ocean oil and gas, and oil transportation by waterborne always have spill and leak incidents in the Gulf. When the different kinds of oil enter the seawater, many physical, chemical and biological degradation processes start acting on them. Some processes cause oil to disappear, but the fact that it is no longer visible on the water surface does not necessarily mean that it is gone or has been rendered environmentally harmless. In order for understanding the fate processes and prediction of impacts of deep-water releases on the marine ecosystem, researchers are continuing to study various components of the Gulf. Such research is useful for assessing the context and limits of future deep-water oil and gas development in the Gulf of Mexico. Our objective is to perform laboratory simulation of dissolution from oiled spill at depth in ocean such as well blow out or pipeline leak, and forecasting droplet sinking time associated with and without dispersant for subsurface solubilization. The experiment was carried out using an 18 gallons glass container equipped with circulation pump and the petri dishes hanger. The sinking time of oil model that made of 20% ortho dichlorobenzene (ODB) and 80% Benzene without dispersant in tap water is 3 days, in salt water with salinity of 30 $^{0}/_{00}$ is 7 days, while with dispersant in tap water is 2 days.

Mass Transfer Characteristics of Organic Drops in Water.

Tyler Nesmith, Abhijit Rao, Rupesh K Reddy and Dr. Krishnaswamy Nandakumar
Louisiana State University, Cain Department of Chemical Engineering, Baton Rouge, LA

Deep water blowouts contain a mix of oil and gas (e.g., Methane), which may remain subsurface for an extended period of time and appear at the surface many miles from the site depending up on the directions and strength of the seasonal ocean currents. Such behavior makes tracking difficult, but more importantly it potentially provides time for the more soluble oil fractions, particularly the smaller aromatic compounds, and gas (eg. Methane) to dissolve. So, it is imperative to account for the mass transfer process that accompanies the rise of the droplets to completely explain the droplet dynamics. In our study, we released multiple droplets of acetone (miscible in water and lighter than water) and chlorobenzene (immiscible in water and heavier in water) from a nozzle in the bottom of a tank filled with water, and we tracked the velocity of the droplets by measuring the height that they rose within certain periods of time. The sizes of the droplets were also altered on multiple occasions by releasing them from nozzles of varying diameters. It was observed that as each droplet rose, the acetone transferred to water. This caused the droplet's density to slowly increase until it became too dense to sink. The mass transfer rate was evaluated by noting the time taken by each droplet to reach its maximum height and calculating the amount of acetone lost in the process.



Investigations into Molecular Volumes of Sodium Decyl Sulfate (SDeS).

Nicholas Altieri, Bin Meng, and Dr. Henry Ashbaugh
Tulane University, Department of Chemical and Biomolecular Engineering, New Orleans, LA.

Using GROMACS molecular dynamics simulation package, interactions between a single sodium decyl sulfate molecule and 500 water molecules were modeled at pressures of 1, 500, 1000, and 1500 bars. Each system was held at a constant temperature of 25 °C and molecule number allowing for a volume to be calculated in the simulation. The first simulation was executed on a timescale of 10 nanoseconds in order to obtain an equilibrium value for the system volume. Ten subsequent production runs were simulated for 2 nanoseconds each to provide statistical average, standard deviation, and standard error values. Using previously determined volumes of 500 water molecules alone at each of the aforementioned pressures were then used to calculate the partial molar volumes of the SDeS molecules.

National Science Foundation
WHERE DISCOVERIES BEGIN

GULF OF MEXICO RESEARCH INITIATIVE

Investigating the effect of oil spills on the environment and human health.