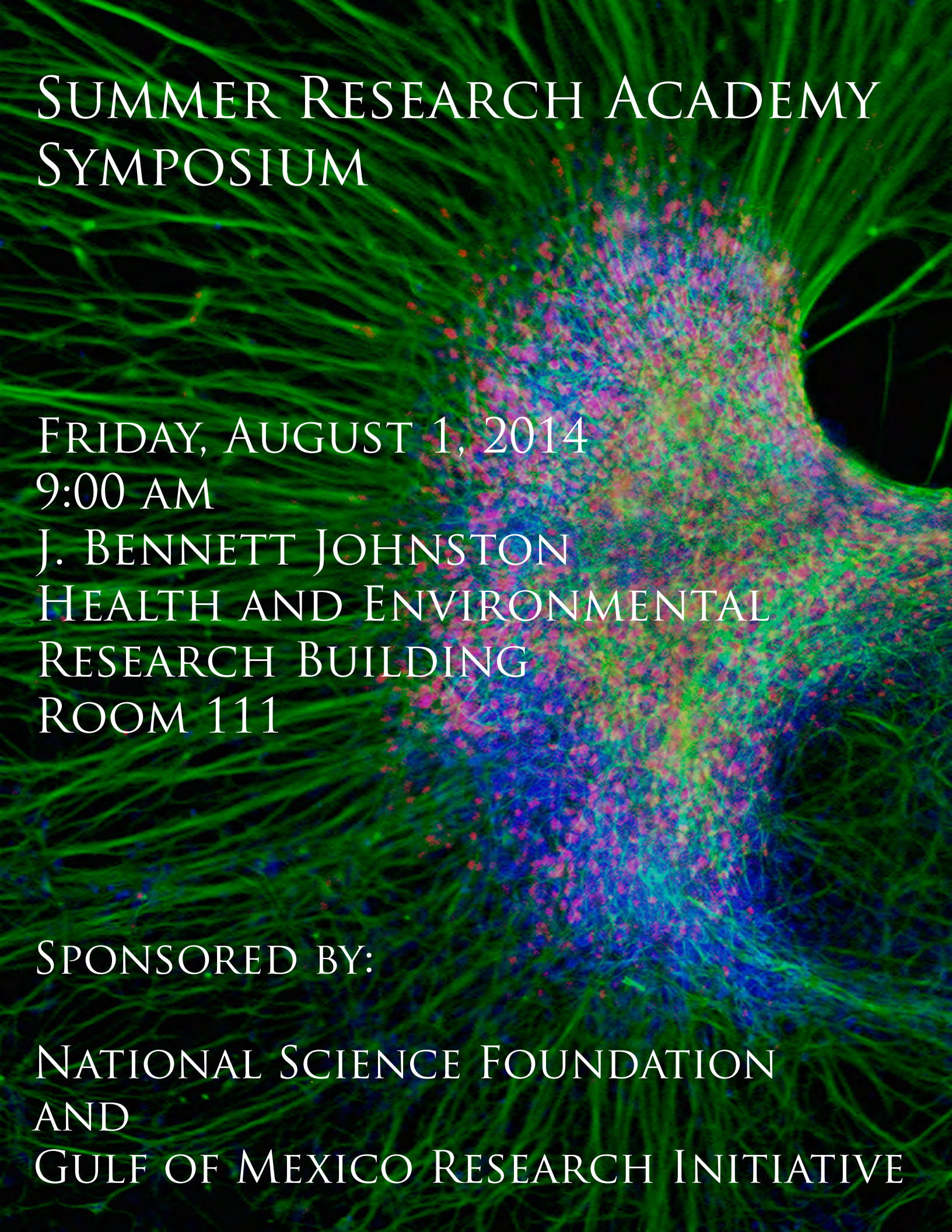

Summer Research Academy Symposium

Friday, August 1, 2014
9:00 am
J. Bennett Johnston
Health and Environmental
Research Building
Room 111

Sponsored by:

National Science Foundation
and
Gulf of Mexico Research Initiative

EDEB 2014 Interns

CMEDS 2014 Interns

Programme

9:00 am	Opening Remarks	
Oral Presentations		
	Presenter(s)	Mentor
9:05 am	Lauren Allen	Anup Kundu, PhD
9:20 am	Samantha Adams	Vijay John, PhD
9:35 am	Brandi Biagas	Bruce Bunnell, PhD
9:50 am	Leonard Bresler	Noshir Pesika, PhD
10:05 am	Hasahn Conway	Harris McFerrin, PhD
10:20 am	Laurent Delafontaine	Vijay John, PhD
10:35 am	Kimberley Dorrah	Cecily DeFreece, PhD
10:50 am	Fabiana Fornerino	Julie Albert, PhD
11:05 am	Clarke Evans	Florastina Payton-Stewart, PhD
11:20 am	Break	
11:30 am	Mary Holleran and Katherine Roberts	Noshir Pesika, PhD
11:45 pm	Kristine Hoang	Matthew Burow, PhD
12:00 pm	He Huang	Kalliat Valsaraj, PhD
12:15 pm	Jacqueline La and Randi Thomas	Matthew Burow, PhD
12:30 pm	I-Ting Liu	Francisco Hung, PhD
12:45 pm	Leticia McDaniels	Qian-Jin Zhang, PhD
1:00 pm	Tuan Tran	Henry Ashbaugh, PhD
1:15 pm	Anthony Nguyen	Patience Obih, PhD
1:30 pm	Gina Nguyen and Tina Phan	Syreeta Tilghman, PhD
1:45 pm	Alexis Vance	Bruce Bunnell, PhD

There will be a reception immediately following the oral presentations.

-All are invited-

Assessment of the Usage of Different Biodegradable Polymers for Liver Tissue Regeneration

Lauren Allen, David Powell, Kyra Dodson, Dr. Syed Muniruzzaman and Dr. Anup Kundu
Xavier University of Louisiana, Department of Biology, New Orleans, LA
Xavier University of Louisiana, Department of Chemistry, New Orleans, LA

The goal of tissue engineering is to augment and assist the normal regeneration process of damaged or diseased tissues. Generally, this is accomplished with synthetic or naturally occurring materials with or without cellular constituents. One critical component of the regeneration process is the extracellular matrix (ECM) that acts as the scaffold onto which the cells adhere, grow, and interact, thereby providing instructional cues to the regeneration of the local tissue. In the case of graft implantation to replace a diseased tissue or organ, the roles of various soluble factors in tissue (i.e. implant) regeneration have been widely studied, but little is known about how the ECM can initiate the normal tissue regeneration while preventing cancer progression. We hypothesize that implanting a perfect ECM analog that will inhibit cancer progression while maintaining the normal cell growth would be an ideal treatment option for cancer. To find a perfect graft material for tissue regeneration, the cell viability of Huh-7.5 liver cancer cells were assayed on thin films of Poly(lactide-co-glycolide) (PLGA), Poly(caprolactone) (PCL), Poly-L-lactic acid (PLLA), Polyhydroxybutyrate (PHB) and silk fibroin. Among all these polymers, the cell viability was observed highest on PLGA and lowest on silk fibroin. Adhesion blocking studies reveal that, Huh-7.5 liver cancer cells adhere to PLGA primarily via vitronectin (VN) and laminin (LN), silk via LN, PCL via collagen (Col-1) and VN, PHB via LN and VN and PLLA via LN and Col-1. Thus, precisely controlling the deposition and synthesis of these ECM proteins by cells within the graft materials (in case these polymers have been chosen for graft implantation) could control the tissue regeneration and cancer prevention.

Interfacially-Active Halloysite Nanotubes as Vehicles for Nutrient Delivery in Oil Spill Bioremediation

Samantha Adams, Olasehinde Owoseni, and Dr. Vijay John
Tulane University Department of Biomedical Engineering, New Orleans, LA
Tulane University Department of Chemical and Biomolecular Engineering, New Orleans, LA

Background: Deploying effective oil spill response procedures are crucial in mitigating the potential harmful impacts of oil spills on the environment. The dispersion of the spilled oil into tiny droplets and subsequent biodegradation of the droplets by microorganisms is often a very effective response mechanism. The dispersion exposes a large oil-water interface for bioremediation. In addition, nutrients are often applied to increase the rate of the biodegradation process. However, due to the large volume of the ocean coupled with ocean waves a significant portion of applied remediation agents may not reach the oil-interface where the remediation processes actually take place. This has significant environmental and economic impact. Therefore, it is important to engineer more efficient, cheaper and environmentally benign technologies for the treatment of oil spills.
Hypothesis: Based on the principles of Pickering emulsions, we hypothesize that surfactants or nutrients can be release from hollow particles that can adsorb at the oil-water interface. We focus on halloysite, a naturally occurring aluminosilicate clay nanotube. If halloysite nanotubes (HNT) can attach to the oil-water interface and stabilize oil droplets, then HNT can be used to deliver nutrients at the oil-water interface.
Methods: HNT were loaded with a model nutrient, urea by vacuum suction of a HNT dispersionin a concentrated urea solution. The particles were recovered by centrifugation and dried to constant weight. Thermogravimetric analysis (TGA) was used to confirm the amount of urea loaded into the HNTs. Once the HNT were loaded with urea, a 0.5 mL solution of 4% (w/v) p-Dimethylaminobenzaldehyde (DMAB) and 4% (v/v) sulfuric acid in absolute ethanol was added to 3 mg of urea HNT diluted in 100 mL of saline water (35 mg/L). The release pattern of the 3mg/100mL sample of urea HNT in saline solution was determined through ultraviolet-visible spectroscopy and characterized through a math modeling. A calibration curve was plotted at four concentrations of urea at 420 nm. Emulsions stabilized by the urea-loaded HNTs were characterized by optical microscopy and Cryo-scanning electron microscopy (Cryo-SEM).
Results: Urea can successfully be loaded in halloysite nanotubes and released at the interface of oil droplets. The release of urea was also characterized by UV spectroscopy and the data was fitted to a mathematical model.
Conclusion: This project's most practical application is in the practice of bioremediation. The controlled release of nutrients at the oil-water interface will ensure adequate nutrient supply to sustain the metabolic activity of oil-degrading microorganisms.

The Effect of Bisphenol Derivatives on ASCs

Brandi A. Biagas, Amy L. Strong, Jason F. Ohlstein, John A. McLachlan, Matthew E. Burow, Thomas E. Weise, and Dr. Bruce A. Bunnell
Xavier University of Louisiana, Department of Biology, New Orleans, LA
Tulane University School of Medicine, Center for Stem Cell Research and Regenerative Medicine, New Orleans, LA
Tulane University School of Medicine, Department of Pharmacology, New Orleans, LA
Tulane University School of Medicine, Department of Medicine - Hematology and Medical Oncology, New Orleans, LA
Xavier University of Louisiana College of Pharmacy, Division of Basic Pharmaceutical Sciences, New Orleans, LA

Bisphenols are a class of endocrine disruptors that are commonly found in plasticware. Exposure to bisphenols have been associated with significant weight gain and potentially linked to obesity. Previously, our group demonstrated bisphenol A enhances adipogenic differentiation of human adipose stem cells (ASCs), the precursors to mature adipocytes, at physiologically relevant concentrations. However, it remains to be determined whether other bisphenol derivatives enhance adipogenic differentiation in a similar manner. Therefore, the objective of this study was to determine whether bisphenol derivatives enhance adipogenic differentiation of ASCs. ASCs from six donors were cultured for either 14 or 21 days in adipogenic differentiation media, supplemented with bisphenol derivatives in increasing concentrations from 100 pM to 10 μM. The following bisphenol derivatives were tested: Bisphenol A, Bisphenol C, DM DMB Bis A, TCL Bis A, MM2, Bisphenol E, Bisphenol F, PPP, HF, Bis A. To assess adipogenic differentiation, cells were stained with Oil Red O to visualize lipid vacuoles. To quantify the degree of adipogenic differentiation, stains were eluted with isopropanol and the optical density was measured at 544 nm. The values were then normalized to the corre sponding protein level assessed with the BCA assay. DM DMB Bis A, TCl Bis A, Bisphenol E, and PPP enhance adipogenesis in ASCs after 14 and 21 days, with maximal effect between 10 nM to 1 μM. DM DMB Bis A, TCl Bis A, Bisphenol E, and PPP enhanced adipogenesis by 1.3-fold, 1.5-fold, 1.7-fold, and 2-fold, respectively. Previous studies have shown that bisphenols enhance adipogenesis through an estrogen receptor dependent pathway; however, additional studies are necessary to determine the precise mechanism by which bisphenols enhance adipogenic differentiation. In summary, bisphenol derivatives enhance adipogenic differentia tion of ASCs at physiologically relevant concentrations, implicating bisphenol in the obesity epidemic

Oil-in-Water Emulsions Stabilized by Colloidal Silica and Carbon Nano-Particles

Leonard Bresler, Shevas Oak, Joseph Cremaldi, and Dr. Noshir Pesika
Tulane University, Department of Chemical and Biomolecular Engineering, New Orleans, LA

A study is presented of the preparation and the characteristics of oil-in-water emulsions stabilized by colloidal silica and carbon nano-particles. Due to the hydrophilic nature of silica and the hydrophobicity of the graphitic carbon, we hypothesized that the particles would align at their respective interfaces to stabilize oil-in-water (O/W) or water-in-oil (W/O) emulsions based on varying properties. Pickering emulsions, created via sonication and vortex mixing, were tested via centrifugation, optical micrographs, and cryogenic-SEM. Post vortex mixing, the emulsions were documented over set time intervals to determine stability while varying the oil to water ratio as well as the silica to carbon particle ratios. Concentrations were varied in order to simulate ocean-like conditions through various trials. We found that an oil-in-water emulsion can be stabilized by silica particles or by carbon particles, but a combination of the two types of particles leads to a synergistic effect, which further stabilizes the emulsion. This approach to emulsion stabilization utilizes environment friendly and cost effective materials to mitigate large oil releases within ocean environments

Anti-Angiogenesis Effect of Rare Keto-Hexoses in Chick Embryo Model

Hasahn Conway, Usman Chaudrey, Moamen Ismail, Kevin Lam, Dr. Syed Muniruzzaman, and Dr. Harris McFerrin
Xavier University of Louisiana, Department of Biology, New Orleans, LA

The practical application, usefulness and physiological effect of rare carbohydrates have not been well investigated because of high costs and low availability. Despite their costs, rare carbohydrates are very important since they have the potential for use in many areas. The main goal of this study was to see the effect of rare keto hexoses on the process of angiogenesis in chick embryo model. Angiogenesis is the fundamental process by which new blood vessels are formed as extensions from the existing vasculature. In this study we have used eight different ketohexoses such as D-Fructose, L-Fructose, D-Psicose, L-Psicose, D-Sorbose, L-Sorbose, D-Tagatose, and L-Tagatose. Out of these eight keto-hexoses one has shown significant inhibition of angiogenesis. This inhibitory effect was also determined to be stereospecific as the D-isomer of the same sugar was significantly more effective than that of the L-isomer.

Meso-Macroporous Silica and CO2 Capture

Laurent Delafontaine, Yueheng Zhang, Yang Su and Dr. Vijay John
Tulane University, Department of Chemical and Biomolecular Engineering, New Orleans, LA

Recently, there has been an unnatural rise in CO2 emissions due primarily to burning fossil fuels. This rise has been shown to contribute to global warming. Therefore, there is an urgent need to discover ways of either reducing our carbon footprint or of capturing CO2 so that this dangerous greenhouse gas cannot further contribute to global warming.
The latter task of CO2 capture is what our research into meso-macroporous silica particles loaded with PEI is aimed at.
Surfactant-templated condensation of silica can be used to produce porous silica particles. The hypothesis is that hydrophobically modified chitosan combined with cetyltrimetylammonium bromide (CTAB) and silicon dioxide will yield a porous silica support that when Polyethylenimine is added, will better facilitate the capture of carbon dioxide.
Hydrophobically modified chitosan (HMC) is made by reacting chitosan with dodecyl aldehyde and then reducing with sodium cyanoborohydride. The resulting HMC might interact with the CTAB micelles to yield silica particles that allow for easier diffusion of PEI and carbon dioxide through the pores.
This porous silica support can be impregnated with PEI so that the product can be used as a sorbent which will capture carbon dioxide. Eventually the saturated sorbent can be regenerated and the carbon dioxide released underground.
In order to characterize the condensed porous silica particles, a range of experimental methods are employed. X- Ray Diffraction, BET Surface Area Analysis, and transmission electron microscopy (TEM) will all be used to observe and describe the synthesized particles.

The Effects of Heavy Metals on LINE1 Endonuclease

Kimberly Dorrah and Dr. Cecily DeFreece
Xavier University of Louisiana, Department of Public Health Sciences, New Orleans, LA
Xavier University of Louisiana, Department of Biology, New Orleans, LA

The phenomenon of host-controlled restriction and modification of a bacterial virus has been a critical part of Polvadenylation (A) retrotransposons research since the 1950's. L1 elements are retrotransposons that go through the RNA intermediate. Polyadenylation (Poly (A) element) is the addition of a poly tail to a primary transcript RNA. The poly tail consists of multiple adenosine monophosphates (a stretch of RNA that has only adenine bases).Poly (A) elements can be subdivided into sequence specific and non-sequence specific types (Fanner & Singer, 1987, pg. 905). Meanwhile, sequence non-specific endonuclease act on both DNA and RNA, cleave double-stranded and single-stranded nucleic acids and require magnesium for their activity(www.ebi.ac.uk, 2014) .The endonuclease (EN) domain of L1 ORF2 has two domain functions that cleave the target site for L1 retrotranposition and generates a reverse transcription primer (Mol, 1995, pg. 906). During the course of the summer, we researched ORF2 and its domain function (endonuclease nicking activity).
L1 is a retrotransposition that is a mobile element that goes through the RNA intermediate. L1 consists of two proteins called ORF1 and ORF2 (Open Reading Frame 1 & 2). ORF1 is not homologous to cellular protein sequences. There is evidence that ORF1 is an RNA-binding protein. ORF2 has two domain functions that encodes for reverse transcriptase (RT) and nicking endocnuclease activity. Reverse Transcriptase (RT) converts single stranded RNA into double-stranded DNA. According to Morgan & Feng (1996), the nicking activity takes place in the endonuclease. The endonuclease cuts through the DNA.

Effect of Solvent Vapor Annealing on the Self-assembly of SIS Block Copolymer Thin Films

Fabiana Fornerino, Baraka Lwoya, Giovanni Kelly, and Dr. Julie Albert
Tulane University, Department of Chemical and Biomolecular Engineering, New Orleans, LA

The aims of this investigation are to examine how the nanostructured morphologies of block copolymer thin films change during solvent vapor annealing (SVA) and to see if they differ according to block copolymer architecture, specifically between the triblock and star architectures. The block copolymers used are polystyrene (S) and polyisoprene (I): vectors 4211A, 4215A and 4293A. Vector 4211A is pure SIS triblock, while vector 4215 is SIS triblock blended with SI diblock and 4193A consists of SI star block copolymer blended with SI diblock . Because all of the polymers have the same polystyrene content (30 wt%), all are expected to form cylinder nanostructures. However, the orientation and long-range order of the cylinders may differ according to architecture and composition.

SVA is the process whereby the nanostructure of a block copolymer is altered using solvent vapor. The parameters that are changed and controlled in these experiments are film thickness, solvent choice, and annealing time. In this work, thin films with 100 nm and 30 nm film thicknesses were produced from polymer solutions in toluene by spin coating onto toluene-rinsed and ultraviolet-ozone (UVO) treated silicon wafers. The speed and acceleration were adjusted for each solution to obtain the desired film thickness. The solvents used for SVA were n-hexane and tetrahydrofuran (THF). The films were annealed under saturated vapor atmospheres for various times. The nanostructures were observed by imaging the annealed samples using an atomic force microscope in tapping mode.

In preliminary results, the as-cast morphologies of 100 nm thick films appear to be the same, namely a structure that resembles short segments of parallel cylinders. However, when annealed in n-hexane, all three polymer vectors exhibit clear hexagonal dot patterns, indicative of a perpendicular cylinder, sphere, or perforated lamellae morphology. The THF anneals for all three polymers are inconclusive so far because annealing times have been limited by film dewetting; all blends display short line patterns consistent with a parallel cylinder morphology, but they needed to be annealed for more time.

Thus far, the results of the 100 nm thick films indicate that our initial hypothesis may be incorrect: the block copolymer architecture appears to have no effect on thin film morphology. Therefore, we are increasing confinement by decreasing film thickness to 30 nm in an attempt to frustrate the system and look for a difference between architectures. Furthermore, longer THF anneal times will be conducted in hopes of attaining a near-equilibrium state and obtaining conclusive results.

Evaluation of Berberine Derivatives As Selective Inhibition of P450s 1A1 and 1B1

Clarke Evans, Dr. Harshini Ratnayaka, Dr. Jiawang Liu, Dr. Ravi Pingali, and Dr. Florastina Payton Stewart
Xavier University of Louisiana, Department of Biology, New Orleans, LA
Xavier University of Louisiana, Department of Chemistry, New Orleans, LA

Berberine is a plant alkaloid that has been used in traditional medicine to treat a wide range of conditions. It is found in a number of plants such as Berberis in the roots, stems, and in bark. In recent years, it has been found to exhibit anticancer activity. The second leading cause of death among women is breast cancer. The American Cancer Society estimates that during 2014, 232,670 women in the United States will be diagnosed with invasive breast cancer and 40,000 women will die from the disease. Most diagnosed breast cancers are estrogen receptor (ER) positive providing a favorable target for endocrine therapy. One of the major cancer risk factors for breast cancer is estrogen. The carcinogenic potential of estrogen might be attributed to DNA modification caused by derivatives formed during metabolism. The main steroidal estrogen present in women, 17 ß-estradiol (E2), is metabolized and forms two major metabolites: 2-hydroxyestradiol (2-OH E2) and 4-hydroxyestradiol (4-OH E2) through the action of cytochrome P450 (CYP) 1A1 and 1B1, respectively. Previous studies suggested that 2-OH E2 has putative protective effects, while 4-OH E2 is genotoxic and has potent carcinogenic activity. Cytochrome P450 (P450, CYP) 1 family plays a primary role in the detoxification and bioactivation of polycyclic aromatic hydrocarbons. In the present study, we investigated the effects of berberine and berberine analogs as P450 inhibitors. We hypothesize that structural modifications of berberine may be lead to effective P450 inhibitors. METHODS: Berberine and berberine analogs have been synthesized using traditional organic chemistry reactions. These analogs will be evaluated for their potential to act as P450 inhibitors using the 7-Ethoxyresofurin De-alkylase-P450 Assay. CONCLUSION: Preliminary data shows that berberine and berberine analogues, Ber and Ber 1-5 could effectively be inhibited by CPY1A1. We conclude that berberine and berberine analogs may prove to be effective P450 inhibitors and beneficial for breast cancer prevention.

Stabilization of Pickering Emulsions through Surface Modification of Hard Carbon Spheres

Mary K. Holleran, **Katherine Roberts**, Joseph Cremaldi, and Dr. Noshir Pesika
Tulane University, Department of Chemical and Bio molecular Engineering, New Orleans, LA

In examining alternative methods for containing and cleaning oil spills, this research focused on development of particles to both stabilize oil in water (O/W) emulsions for bacterial consumption while also preventing coalescence of the oil drops onto various oleophilic surfaces found in environments most directly affected by oil spills. The use of graphitic, hard carbon spheres possibly achieves both goals through the formation of Pickering emulsions for stabilization and the introduction of steric barriers at the interface for coalescence prevention. Untreated graphitic carbon spheres sit primarily in the oil phase, however, and creation of oil in water emulsions requires the particles to be biased towards the water phase at the interface. The carbon spheres will be coated with polymer brushes to increase hydrophilicity and adjust their position in the emulsion. To determine the most effective polymers for this purpose, wafers were coated with PMMA 12K, PMMA 7K, Polystyrene 17K, Polystyrene 100K, and polyvinylidene fluoride. Contact angle analysis was utilized to provide a quantitative indication of the hydrophobicity/hydrophilicity of the surface, providing an idea of which polymer will be best suited for modifying the hard carbon spheres. Preliminary results show that the PMMA 7K provides the most hydrophilic contact angle, which will be most applicable for this line of experiments.

The Effects of MEK1/2 and MEK5 Inhibition in Colon Cancer

Kristine Hoang, Van Hoang, and Dr. Matthew E. Burow
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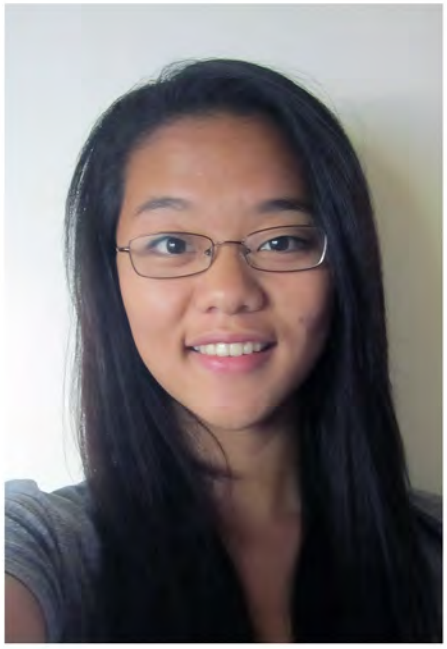
Tulane University Department of Medicine, Section of Hematology and Oncology, New Orleans, LA

The mitogen-activated protein kinase (MAPK) pathway has well-established roles in cellular proliferation, survival and apoptosis. Constitutive activation of the MAPK/extracellular signal-regulated kinases (ERK) pathways have been linked to chemoresistance and metastatic progression through activation of epithelial-to-mesenchymal transition (EMT), a process where epithelial cells gain motile and invasive capabilities. Previous studies in our lab have shown that overexpression of MEK5, an activating kinase in the ERK pathway, promotes expression of EMT markers and induces the progression to a mesenchymal phenotype. Additionally, inhibition of MEK1/2,5 reversed EMT in cancer cell lines harboring a k-RAS mutation. Based on these findings, we hypothesized that inhibition of MEK1/2,5 will reverse EMT in k-RAS-mutant colorectal cancer cells. SC-1-151 inhibited proliferation of both k-RAS wild-type and mutant colorectal cells. Analysis of gene expression by quantitative real time polymerase chain reaction (qPCR) showed downregulation of migration and invasion mediators Fra-1 and EGR1 after SC-1-151 treatment. Future directions include morphological assessment of additional colorectal cancer cell lines to elucidate the reversal of EMT induced by MEK1/2,5 inhibition in k-RAS mutant cancer cells.



The Contribution of Different Surfactants within Corexit in Ejection of Oil/Dispersant Material into the Atmosphere

He Huang, Paria Avij, and Dr. Kalliat T. Valsaraj
Louisiana State University, Cain Department of Chemical Engineering, Baton Rouge, LA

We are studying the aerosolization of oil/dispersant matter by whitecaps, which are simulated by bursting bubbles in a laboratory aerosolization reactor. In this summer project, we investigated the effects of two different surfactants within the Corexit (DOSS and Span 80) in ejection rates of organic material into the atmosphere. This study showed us different behaviors of ionic (DOSS) and non-ionic (Span80) surfactants when they interact with surrogate oil in the aerosolization reactor.
Mixtures of surrogate oil and the same molar concentration of each surfactant were prepared and injected into the reactor by a syringe pump. At the reactor's steady point, both gas and particle phases were collected at the top of the reactor and analyzed by GC-MS/GC-FID for their alkane content. We also measured the surface tension of the water inside the reactor by tensiometer to track surface tension changes caused by surfactant application. Our experimental results clearly demonstrate that Span 80 contributes more in the ejection of organic matter into the atmosphere in comparison with DOSS and that it is much more significant in the ejection of non-volatile groups of oil matter. In contrast, DOSS is more efficient in dispersing organic matter inside the water column. We also sampled particles, stemming from whitecaps, near the shoreline of Long beach, Mississippi with an electrostatic precipitator. This field sampling enabled us to compare our laboratory produced particles with in-field particles based on size and chemical distribution.

Assessing EMT in Breast Cancer

Jacqueline La, **Randi Thomas**, Hope Burks, Van Hoang, and Dr. Matthew Burow
Xavier University of Louisiana, Department of Biology, New Orleans, LA
Tulane University Department of Medicine, Section of Hematology and Oncology, New Orleans, LA

Statistics show that 1 in every 8 women in the United States will develop breast cancer in their lifetime. Metastasis is responsible for approximately 90% of all cancer-related deaths. In metastasis, cancer cells migrate from the primary tumor sites and form colonies in distant tissues. Activation of epithelial-to-mesenchymal transition (EMT) is an integral part of cancer metastasis. During EMT, well-organized cobblestone-like cells undergo morphological changes to become elongated and fibroblast-like cells. Additionally, cells lose expression of E-cadherin, an epithelial marker/adhesion junction and acquire expression of mesenchymal markers, such as vimentin and N-cadherin. Ultimately, the changes in gene expression involved in EMT allow for cell migration. Here, we examined the major characteristics of EMT: cell morphology and gene expression. Crystal violet assays were performed to look at cell morphology. Quantitative real time polymerase chain reaction (qPCR) was used to determine gene expression changes associated with EMT (e.g. ZEB1, ZEB2, Twist, vimentin, SNAI1). Cell motility and invasive potential were quantified by trans-well migration and invasion assays, respectively. Investigation of EMT provides important insights into mechanisms of tumor metastasis.

Molecular Simulation of Hydrophobins near Interfaces of Oil, Water, and Gas

I-Ting Liu, Yuwu Chen and Francisco R. Hung
Louisiana State University Cain Department of Chemical Engineering, Baton Rouge, LA

The Deepwater Horizon oil spill in March of 2010 released about 4.9 million barrels of oil into the Gulf of Mexico. About 1.8 million gallons of Corexit oil dispersant were used to combat the oil spill and minimize impacts in the shorelines, however the toxicity effects of this strategy are still a controversial topic of debate nowadays. In the quest to design novel dispersants that are more environmentally friendly, in this project we have focused on hydrophobins near interfaces involving oil, salt water and gas. Hydrophobins are a class of proteins produced by filamentous fungi, and have hydrophobic and hydrophilic regions. Experimental results indicate that these proteins can encapsulate oil in cylindrical 'blobs', or gases in cylindrical bubbles, which implies a striking surface activity. As a part of long-term efforts aimed at understanding the molecular principles behind this striking behavior, in this project we conducted classical molecular dynamics simulations of hydrophobins near interfaces of oil, salt water and gas. All-atom and coarse-grained models were used in our simulations. Density profiles show that the hydrophobin is present in both the oil phase and water phase, however the majority of the hydrophobin is in the water side of the interfaces. All of our simulations show that the hydrophobin moves from the water phase into the interfaces and stays there for most of the simulation. Overall, this project is part of long-term research efforts that aim at understanding the interfacial properties of hydrophobins at the molecular level, with the hope of harnessing their capabilities for the design of novel dispersants that are more friendly to the environment..

Highly and Moderately Aggressive Mouse Ovarian Cancer Cell Lines Exhibit Differential Gene Expression

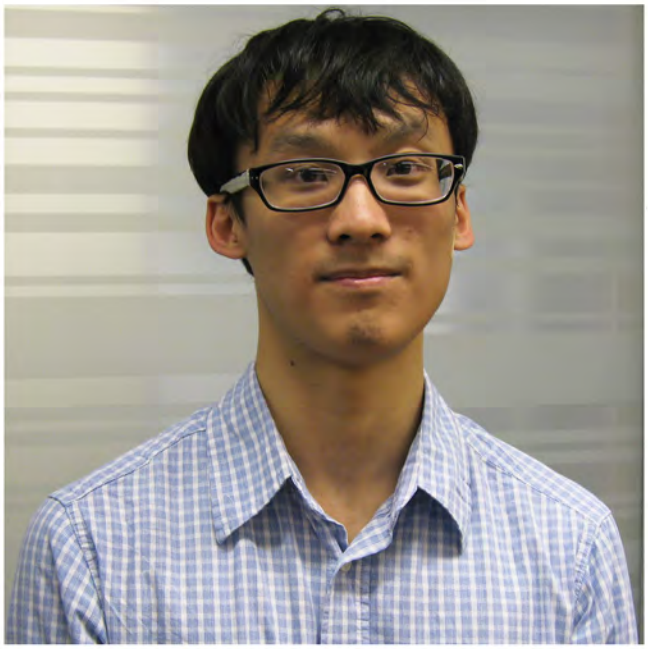
Leticia McDaniels, Fengkun Du and Dr. Qian-Jin Zhang
Xavier University of Louisiana, Department of Biology, New Orleans, LA

Ovarian cancer is the fourth most leading cause of cancer among women and one of the most fatal gynecological malignancies. In a clinical setting, ovarian cancer prognosis is dependent on the stage at which the disease is diagnosed (early stage, better survival rate; advanced stage, worse survival rate). Biomarkers that are relevant to the characteristic of ovarian cancer and can be used for clinical detection have not been published. We have developed a set of mouse ovarian cancer cell lines to investigate molecular biomarkers for prognostic detection. The cell lines exhibited both highly and moderately aggressive phenotypes in vivo that relate to different survival time and rates, presenting different prognostic potentials. With the use of an Affymetrix Mouse Genome 430 2.0 Array, 209 transcripts were differentially and significantly expressed by two-fold or greater amount between the highly and moderately aggressive cell lines. Of the 209 transcripts, 169 genes and 15 transcribed loci were only available since several genes had more than one transcript on this array. According to GeneSifter software analysis, two groups of the genes were identified. Group 1 contained 64 genes and 11 transcribed loci that were highly expressed in the moderately aggressive cells. Group 2 contained 105 genes and 4 transcribed loci that were highly expressed in the highly aggressive cells. These results suggested that the highly and moderately aggressive ovarian cancer cells expressed different sets of genes at different levels. Gene products in groups were involved in various cancer-related signal transduction, including p53, TGF-beta, metabolic regulation, cell cycle regulation, DNA replication, ABC transporters, and apoptosis. Some gene products in both groups were involved in the same pathways while others were involved in different pathways. This suggested that differences in gene expression in signaling pathways resulted in tumor cells displaying different malignant phenotypes in vivo. Our results provide important information for investigation of human ovarian cancer prognosis.

Thermodynamic Insights into Surfactant Assembly in Protic Ionic Liquids

Tuan H. Tran and Dr. Henry S. Ashbaugh
Tulane University, Department of Chemical and Biomolecular Engineering, New Orleans, LA

In response to the 2010 Deepwater Horizon Oil Spill, the major strategic effort of controlling overreaching spread of crude oil was the use of dispersant. However, much is unknown of the driving forces behind the solvation process and assembly of micellar structures of said dispersant. Protic Ionic Liquids (PILs), are simple, easily manufactured, and highly modifiable dispersants; and by extensively exploring the thermodynamic properties of PILs we hope to reveal some guiding information into their behaviors.
A series of alkyl-ammonium nitrates were studied using molecular dynamics simulations in GROMACS. As previously studied, computed densities and radial distribution functions were compared against experimental data, and has in great part verified the simulation models used. In the subsequent study, further effort was made towards model verification by reproducing small-angle X-ray scattering (SAXS) data and free energies of methane insertion. However, with large antagonistic consequences, unusually low rates of diffusion were evident. Thus, further experimentation was done so as to increase the fluidity of the models. Because the occurrence of charge transfer in the alkyl-ammonium nitrate series was largely disputed, other solutions are currently being pursued including a careful ab initio RESP charge remodeling and a replica exchange experiment. It is essential to obtain a highly verified model of these PILs before any studies on molecular structure can be entertained.
We believe that these continued studies will be the foundation for future research on surfactant micellization in alkylammonium nitrates as well as directly aiding future studies on other protic ionic liquids.



Antidiabetic Action of *Taraxacum officinale* (Dandelion)

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Diabetes mellitus is the seventh leading cause of death in the U.S., and affects over 29 million people (around 9% of the population in 2012). Risk factors for this disease include genetic predispositions (Type 1 and Type 2), lifestyle and diet (Type 2), and pregnancy (gestational). Numerous complications can arise from diabetes mellitus and include, but are not limited to: retinopathy, neuropathy, and nephropathy. Aggregate costs for diabetes (medical and derived costs) exceeded 245 billion dollars in 2012. Medical costs for diabetes patients are double that of people without diabetes. Oral hypoglycemic medication and insulin have been widely used to control Type 2 diabetes, but have undesirable side effects and are costly. Recent approaches to controlling postprandial blood glucose levels have involved α-glucosidase inhibition, which delays the cleaving of polysaccharides and uptake of resulting monosaccharides. Acarbose and miglitol are prescribed α-glucosidase inhibitors; however, they both have marked side effects. Therefore, there is a need for the study of alternative antidiabetic medication. Studies have pointed to the hypoglycemic effects of plants such as *Taraxacum officinale* (dandelion). It was hypothesized in this study that *Taraxacum officinale* would inhibit α-glucosidase activity. This study utilized aqueous extracts of dandelion at various concentrations that were studied in vitro. The assays were prepared on 96 well plates and absorbances were read on a ThermoScientific® Multiskan spectrophometer. Preliminary runs show promising results that are indicative of α-glucosidase inhibition (EC50= 0.4 mg/mL), however, more tests need to be conducted to determine the efficacy of the extracts. More studies (including in vitro, in vivo, histological, pharmacodynamics, and pharmacokinetic studies) also need to be conducted to determine the potency and safety of the plants.

A Novel Phyto-Antiestrogen Restores the Epithelial Phenotype in Letrozole Resistant Breast Cancer

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Although aromatase inhibitors, such as letrozole, are the standard endocrine therapy of choice for postmenopausal women with early-stage metastatic estrogen-dependent breast cancer, the major limitation in managing this disease is the development of drug resistance. As a result, a better understanding of this process is critical towards developing novel strategies and therapies to manage this disease. As such, many naturally occurring agents, particularly soy-containing compounds such as glyceollins, have gained interest as potential therapeutic breast cancer agents. Several appear to directly affect tumorigenesis of estrogen-dependent and independent breast cancers. The objective of this study was to examine the effect of glyceollin I as a potential therapeutic strategy to overcome letrozole resistance. Morphological studies and immunofluorescence were performed in letrozole resistant breast cancer cells (LTLT-Ca) and results demonstrated that glyceollin I reversed the morphology of the LTLT-Ca cells while restoring e-cadherin expression, respectively. Here, we demonstrate for the first time, the potential of a novel phytoalexin, glyceollin I, to restore LTLT-Ca cells to a less aggressive epithelial phenotype, which may potentially represent a novel approach to treating metastatic, endocrine resistant breast cancer.

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BPA-Associated Dysregulation of ASCs on Breast Cancer Cells

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Bisphenol A (BPA) is a chemical monomer found in plastics and epoxy resins, such as plastic ware, canned goods, and baby bottles. Novel efforts are being made to understand the precise mechanisms by which BPA enhances breast cancer tumorigenicity. For example, recent studies have shown that BPA, a synthetic estrogen, may increase the risk of developing estrogen-positive (ER+) breast cancer. More specifically, BPA activates estrogen receptor dependent pathways in ER+ breast cancer cells, which can make the cancer cells more aggressive. Adipose stem cells (ASCs), derived from adipose tissue, release hormones that can promote an increase of breast cancer tumorigenesis and metastasis. By exposing ASCs that have been co-cultured with ER+ cancer cell lines (MCF7, ZR75) to low levels of BPA, it is hypothesized that ASCs will express increased proliferation and genetic activity. PCRs were conducted to investigate the levels of various cancer-associated markers, such as lipoprotein lipase (LGL) and insulin-like growth factor-1 (IGF-1). Results from PCRs (confirmed or denied) the hypothesis that BPA aids in the cellular dysregulation of ASCs on cancer cells.

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