XV Sigma Xi Poster Day
Presented by Sigma Xi, The Scientific Research Society
Mayagüez Chapter No. 511

PROGRAM AND ABSTRACTS

Thursday, April 8th, 2010
Chemistry Building
UPR-Mayagüez

Prepared by Dr. María A. Aponte and Dr. Emilio Díaz
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SIGMA XI: HISTORY AND PURPOSE

Sigma Xi was founded in 1886 by a group of Cornell University students and a faculty member who believed that the time had come to establish an honor society for scientists and engineers. Although other societies were well established in the humanities, none existed for science scholars. To fill this void, the Cornell group established a society to reward excellence in scientific research and to encourage a sense of companionship and cooperation among scientists in all fields. They called the organization Sigma Xi and identified it with a unique combination of Greek letters. A motto based on these initials was later adopted to confirm the purpose of the Society: “Spoudon Xynones”, or “Companions of Zealous Research”. Over the years, Sigma Xi grew to include more than 500 chapters and clubs across North America and abroad. Although until World War II Sigma Xi groups had been situated almost exclusively at academic institutions, many members recognized that a lot of scientific research was being done at other locations, such as governmental and industrial laboratories. To serve these latter groups of scientists, the Scientific Research Society of America (RESA) was formed. In 1974, RESA and Sigma Xi merged, and in 1976 the Society adopted its present name: Sigma Xi, The Scientific Research Society.

Membership in Sigma Xi is by invitation and election is for life. Since its creation, the Society has elected about 365,000 members, of whom over 100,000 are currently active. The most promising young scientists and students with demonstrated research potential are usually invited to join as Associate Members. Full membership is conferred upon individuals who have demonstrated noteworthy achievements in research. Each year Sigma Xi initiates about 5,000 new members worldwide.

Through its programmatic thrust, the Society is making many contributions in areas of interest and concern to researchers such as:

- Encouragement of young investigators
- Science Education
- Health of the research community
- Interactions of science, technology, and society
- Enhancement of the public’s understanding of science and technology
- Ethics in science
- Interdisciplinary exchange of ideas

The Sigma Xi Mayagüez Chapter was founded (as a Club of Sigma Xi) in 1961, and from its inception, has been guided by the same principles set forth by the Cornell group 115 years ago: a) to promote the promise of science and technology, b) to enhance the public’s awareness and appreciation of science, c) to foster interaction among scientists from all disciplines, and d) to honor scientific research accomplishments.
MAYAGUEZ CHAPTER OFFICERS (2009-2010)

Dr. Luis A. Rivera, Department of Chemistry, President
Dr. María a. Aponte, Department of Chemistry, Secretary
Dr. Dennis Collins, Department of Mathematics, Treasurer

ACKNOWLEDGEMENTS

The Board of Directors of the Sigma Xi Mayagüez Chapter #511 wishes to thank the sponsors of this event. We appreciate the ongoing financial support that the Sigma Xi National Headquarters in Research Triangle Park, North Carolina, has provided for our chapter’s activities over the years. We are especially grateful for the funds and logistical support of the University of Puerto Rico-Mayagüez, in particular the Office of the Chancellor and the Department of Chemistry. We also thank the ACS Student Chapter at UPR-Mayagüez for their invaluable help with publicity and registration. We acknowledge the indispensable contributions of the mentors and funding agencies that have made student research on our campus possible. Above all, we thank all the students who have agreed to participate in the Sigma Xi Poster Day.
Dear participants:

It is our pleasure to welcome all of you to the BioMINDS Annual Poster Day. This year we join efforts with Sigma Xi in sharing the research experiences of 48 undergraduate students of science and engineering, performing bioscience research projects. The Biotechnology Mentorship Initiative to Develop Science Program is a systemic University of Puerto Rico project supported by a generous grant from the Amgen Foundation that started three years ago with the objective of strengthening scientific skills in our undergraduate curriculum. This year the second cohort of BioMINDS students will be sharing their research experiences of the past academic year. The projects reflect the effort of the UPR-Mayagüez undergraduate students under the excellent guidance of our research faculty mentors. The variety of topics to be covered in the scientific posters is a sample of the diversity and interdisciplinary scope of the BioMINDS initiative.

Our special thanks are due to the Sigma Xi organizers, as well as to the 24 UPR-Mayagüez faculty mentors that have opened their laboratory doors and provided our participating students with experiences in cutting-edge technology and research. Their contribution to our future generation of scientists and engineers is of paramount importance in the establishment and consolidation of a robust knowledge-based economy.

Enjoy the activity!

Dr. Rosa Buxeda
BioMINDS Director

Dr. Lorenzo Saliceti
BioMINDS Co-Director
PROGRAM

• 12:00 pm  Registration and mounting of posters; Lobby, Chemistry Building

• 1:00 pm  Poster exhibition begins Lobby, Chemistry Building

• 2:30 pm  Coffee Break Lobby, Chemistry Building

• 4:30 pm  Presentation on “AH1N1 Virus” Dr. Nanette Diffoot, Biology Department Abbott Room (Q-123), Chemistry Building

• 5:30 pm  Dinner First Floor, Chemistry Building

• 6:30 pm  Certificate distribution First Floor, Chemistry Building

• 7:00 pm  Exhibition ends
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P1
CORRELATION BETWEEN FETAL HEMOGLOBIN LEVELS IN RETICULOCYTES OF NORMAL AND SICKLE CELL PATIENTS UPON BUTYRATE INDUCTION

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Sickle Cell Anemia (SCA), a chronic and often debilitating disease, results from homozygosity for a single amino acid substitution in the β-globin subunit of the hemoglobin molecule. Sickle hemoglobin (HbS), the product of this mutation, polymerises when deoxygenated, thus damaging the red blood cells (RBC) and causing vasoocclusive complications and hemolytic anemia. Stress erythropoiesis in SCA has been postulated to accelerate erythropoiesis and production of hemoglobin F containing RBC (F cells) by reactivation of γ-globin. A significant increase in intracellular reticulocytic concentration of fetal hemoglobin (HbF), a product of the γ-globin gene, inhibits polymerization of HbS and consequently the sickling phenomena. Sodium butyrate (NaBu) is a short-chain fatty acid known to induce cell differentiation, inhibit proliferation and induce gene expression, particularly γ-globin. Previous research suggests that sodium butyrate treatment stimulates HbF production by promoting translation of preexisting γ-globin mRNA. We hypothesized that excess γ-globin mRNA is present only in reticulocytes during stress erythropoiesis, but not normal erythropoiesis. To understand this, first we isolated reticulocytes from SCA patients not on hydroxyurea treatment or chronic transfusions (stress reticulocytes), and from normal donors (normal reticulocytes) and compared human γ-globin RNA and protein levels. Human γ-globin RNA expression levels were measured by real time RT PCR and hγ-globin protein was measured by HPLC. There was no baseline difference in the hγ-globin RNA expression between normal and stress reticulocytes. Then, in order to study whether increase in hγ-globin protein levels upon butyrate induction is a feature of stress erythropoiesis, reticulocytes were incubated in vitro with or without NaBu at concentrations of 1mM, 2mM and 5mM for 24 and 48 hours. After NaBu treatment, reticulocytes were analyzed for hγ-globin RNA levels and hγ-globin protein expression. Similar levels of Hγ-globin RNA were expressed in sickle samples with and without previous treatments. Increase in hγ-globin protein levels was observed in samples incubated with NaBu for 48 hours. Although a slight increase in hγ-globin protein was observed in sickle reticulocytes, given the limited number of SCA samples, statistical significance was not observed in the levels of hγ-globin protein expression between normal and stress reticulocytes and more samples need to be analyzed for conclusive results. Results from our studies done so far indicate that though there is significantly higher percentage of reticulocytes in SS patients, hγ-globin RNA levels in reticulocytes are similar to normal subjects. Upon induction with NaBu, reticulocytes of SS patients showed higher levels of hγ-globin protein compared to normal subjects, suggesting that increase in HbF protein levels is a feature of stress erythropoiesis.

P2
EFFECTS OF THERMAL OXIDATION OF GAMMA-TITANIUM ALUMINIDE AT 500°C AND 700°C ON HUMAN OSTEOBALST CELL ADHESION

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Prosthetic technology is in search for cost efficient materials that comply with the specifications of biocompatibility, corrosion resistance and optimal mechanical qualities. Thermal oxidation seems to be a promising method to generate highly corrosion resistant and biocompatible surfaces for implant applications. In this experiment, titanium alloys: gamma-TiAl and Ti-6Al-4V, where thermally oxidized at 500°C and 700°C in air to generate an oxide layer. Human Fetal Osteoblast cells (hFOB1.19) were used to examine cell adhesion and osseointegration on thermally oxidized surfaces by the presence of focal adhesion points. hFOB1.19 cells were grown for 24 hours on titaniuin surfaces. An immunofluorescence labeling assay was performed to determine the expression of vinculin, a protein present at focal points. Preliminary results show that hFOB1.19 cells were able to attach on gamma-TiAl disks thermally oxidized at 500°C and 700°C, but failed to do so on Ti-6Al-4V disk oxidized at 700°C.
P3
SYNTHESIS OF CIS-[PtCl₂(NH₃)(L)] COMPLEXES WITH 4-METHYL-THIAZOLE AND 2,4,5-TRIMETHYLTHIAZOLE
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Platinum complexes are well known for their activity against cancer, being cisplatin ([cis-[PtCl₂(NH₃)₂]] the most widely used drug of this group. The main goal of this project was to prepare complexes of the type cis-[PtCl₂(NH₃)(L)]. The replacement of an NH₃ group in cisplatin by a planar N-donor ligand (L) is expected to result in a more stable drug by hindering the approach of inactivating bio-molecules to the Pt center. The complexes cis-[PtCl₂(NH₃)(L)], L = 4-methylthiazole (1) and 2,4,5-trimethylthiazole (2) were prepared by the direct reaction of an aqueous solution of K[PtCl₂(NH₃)] with an ethanol solution of ligand in a 1:1 (Pt/ligand) molar ratio. The products were characterized by ¹H-nuclear magnetic resonance, Raman spectroscopy, infrared spectroscopy, and elemental analysis. Elemental analysis (C, H) of the complexes confirmed the purity of the products. In the NMR spectra, the aromatic protons of ligands in the complex show downfield shifts, which indicated the removal of electron density as a result of the coordination to platinum. The broad signal at 4.47 ppm integrated to three, and was assigned to NH₃. The Raman spectrum of the cis-[PtCl₂(NH₃)(4-methylthiazole)] showed Pt-Cl stretching bands at 330 cm⁻¹, and the Pt-NH₃ band at 535 cm⁻¹. The IR spectra also demonstrated the mixed-amine nature of the complexes: vibrations due to the NH₃ ligand are present (e.g. 3040 to 3500 cm⁻¹, N-H symmetric stretching) as well as bands due to the thiazole ligand. The spectral studies confirm that the syntheses were successful, and the products consist of the desired mixed amine cis-[PtCl₂(NH₃)(L)] complexes. Studies of their reactivity toward bio-molecules will be pursued.

P4
EFFECT OF PH MEDIUM ON BRYOPHYTE GROWTH: A STUDY FOR PROTOCOL OPTIMIZATION
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Anthropogenic disturbance has taken a toll in bryophyte species diversity and richness. Bryophyte in situ or ex situ culture has aided in the restoration and conservation of endangered species. For neotropical species, it is poorly understood how ex situ technique like in vitro culture may affect these plants. The medium pH is a factor that can influence spore and asexual propagules germination and protonema or gametophyte module differentiation. Therefore, effects of medium pH (4, 5, 6) on gametophyte modules (Neckeropsis disticha, Pilotrichidium antillarum, Pottiaceae sp.), spores (Octobalplus alobium and Sematophyllum subsimplex), and asexual propagula (Calymperes afzelii) were studied to observe species requirements for optimal growth and differentiation. Plants samples were inoculated into autoclaved petri dishes that contained different pH treatments (4, 5, 6) and ½ MS medium. At 5 weeks of culture, variation in plant modules growth was measured and compared between pH treatments for each species. Species demonstrated various growth patterns. Among treatments, low survival limited the production of gametophyte modules in Pottiaceae sp. While, Neckeropsis disticha and Pilotrichidium antillarum were able to grow, but did not vary between different pH values. In some species (Octobalplus alobium & Calymperes afzelii) there was a tendency to increase growth when pH was augmented. However, in Sematophyllum subsimplex growth increased when pH medium was lowered. The augmentation/lowering of pH may alter or not growth pattern, this will depend on the species requirement. Further detail studies in pH ranges (4-5, 5-6) will elucidate the necessary media for optimal bryophyte species growth.
P5
IN VITRO CULTURE AND STUDIES ON THE SUBMERGE ANGIOSPERM THALASSIA TESTUDINUM
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Thalassia testudinum is the most common and abundant seagrass in the Caribbean, till these days no one has micropropagate T. testudinum in axenic conditions. Micropropagation of plant species is the name for the different sterile techniques and strategies that make possible the development of new plants from cells, tissues and organs. The major obstacle for developing tissue cultures of submerged marine plants is the difficulty in obtaining axenic cultures. Two tissue samplings of T. testudinum were obtained from La Parguera in Lajas, Puerto Rico. Several sterilization protocols and various Murashige and Skoog medium concentrations were used in terminal rhizome segments, bearing apical meristems and three to five nodes in order to obtain axenic T. testudinum explants. Standard sterilization procedures commonly used for terrestrial plant material were insufficient for obtaining sterile axenic T. testudinum. Surface and endophytic bacteria, as well as fungi, were prevalent on the seagrass tissue sampled. The multi-step sterilization protocol used produced axenic plants in about 41% of the explants; however some of viable plants were contaminated. Further research is needed to develop a reliable sterilization protocol and to determine the precise nutrient requirements to develop viable, uncontaminated explants.

P6
DISTRIBUTION OF INTEGRONS AMONG DIFFERENT ENVIRONMENTS IN PUERTO RICO
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The extensive use of antibiotics over the years has created drug-resistant bacterial pathogens. This has represented the most important problem of infectious pathology and human health. The concern is that the pools of genes responsible for the antibiotic resistance are using horizontal transferring to move through the environment. One of the mechanisms responsible for the transferring of genes is the mobile genetic element called integrons. With the discovery of integrons a new field of research is open to determine antibiotic resistance on the free environment. According to this, different locations in Puerto Rico (including impacted and non-impacted zones) were sampled during the year. The samples were processed using serial dilution methods and then inoculated on TSA and R2A media with the antibiotics Cyclohexamide, Sulfadiazine and Kanamicine and incubated at 25 °C. Genomic DNA from resistant colonies was used as template for the detection of integron-based elements by PCR using universal primers. Positive strains will be further screened to detect the type of integron present by PCR. Preliminary results demonstrate that integron-based antibiotic resistance is widespread in the environment and it is not limited to impacted areas.

P7
DETECTION OF CLINICAL INTEGRONS IN TROPICAL COASTAL ENVIRONMENTS.
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Antibiotic resistance represents a serious problem within in the clinical environment. It has been demonstrated that clinical bacterial isolates are carriers of genetic elements known as integrons. Integrons can be laterally transferred between diverse bacterial groups and have the capacity to recruit several genes encoding resistance against different antibiotics. Furthermore, they are known to be prevalent among bacterial populations associated with fecal niches. In Puerto Rico, coastal environments are constantly exposed to wastewater discharges. However, whether these critical habitats may become stable reservoirs of integrons and integron-associated resistance determinants has not been evaluated. To test this hypothesis we are using PCR-based methods targeted at specific sequences of the integrons most commonly found in hospital environments (classes 1-3). Our preliminary results indicate the presence of each of the tested integron classes in total DNA from an impacted estuarine environment and discharges from a coastal pipeline outfall. These findings suggest that contaminated coastal environments are stable reservoirs of integrons that could be potentially loaded with antibiotic resistance genes.
P8

ISOLATION OF COPROPHILOUS FUNGI AT POULTRY INDUSTRIES OF PUERTO RICO
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The persons who are exposed to big quantities of fecal dregs for being employs at Poultry Industries commonly present respiratory diseases, dermatophytosis, among others. One of the possible reasons can be for the presence of pathogenic fungi with the capacity of use the droppings as substratum which is known as coprophilous fungi. Our goal is to identify fungi associated with the fecal dregs of laying hens obtained at poultry industries of Puerto Rico. The samples were divided into two groups for identification: yeasts and molds. To identify the yeasts it was used the morphology, biochemical and Analytical Profile Index-API tests, and for the molds we realized flakes, pure cultures and humid chambers. The results were the following ones: identified yeasts of the gender Candida sp., Cryptococcus sp. and Rhodotorula sp. and for molds as Penicillium sp., Cladosporium sp., Tripospermum sp., Curvularia sp. Gonabotrytis sp., Aspergillus sp. Nigrospora sp., Bipolaris sp. and a Coelomycete. It was found a great diversity of species in the poultry fecal dregs; that of one or another way affect the human health as a consequence of been in contact with droppings. Future studies will be analyzing more poultry industries and establishing managing process of fecal dreg waste. Our acknowledgement is to the Biology Department and Microscopy Center from the University of Puerto Rico-Mayagüez campus (UPRM), Carolyn Rivera Technician of Medical Mycology laboratory and Minority Access to Research Careers (MARC).

P9

CHARACTERIZING A SOIL ISOLATED PURPLE PIGMENTED BIOPROSPECT FOR ANTIMICROBIAL AGENT PRODUCTION
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According to studies, from 1999 to 2006 MRSA (Methicillin-resistant Staphylococcus aureus) related diseases have raised a total of 90% in the United States. Estimates show that around 20,000 people die each year from MRSA strains and that treatments can range from 3,000 to 35,000 dollars per case. These and other facts clearly state why the detection of novel antimicrobials is of utmost importance. The number of antimicrobial-resistant pathogen organisms rises, while the quantity of novel antibiotics decline. Soil has proven to be a rich source of microbial diversity and activities and activities such as antimicrobial agent production. We sought to characterize a soil bioprospect and its potential in antimicrobial production. We intend to identify the microorganism by using morphological, biochemical and molecular techniques such as Scanning Electron Microscopy, DNA extraction, Polymerase Chain Reaction and in silico analysis. Morphologically, the colonies presented circular shape, white color in early stages and subsequently a purple pigment. Microscopically there are filamentous structures much like pseudo-mycelial growth. The SEM analysis suggests the presence of arthrospore-like segmentation. Molecularly, after genomic DNA extraction, the 16SrDNA was amplified by PCR. The amplicon was studied and the in silico analysis suggests that the bioprospect is an actinomycete that belongs to the Streptomycetes genus. Experiments are in progress to test the potential of the Actino-bio to produce antimicrobial agents. Further research is needed to understand the behavior of the microorganism and complete the characterization in terms of biochemical reactions, serological and physiological tests.
P10
SYNTHESIS AND CHARACTERIZATION OF Pt(II) COMPLEX WITH 2-(4-THIAZOLYL)BENZIMIDAZOLE AND 2-MERCAPTO-1-METHYLMIDAZOLE
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The success obtained by cis-[PtCl₂(NH₃)₂] as an anticancer drug has stimulated scientists to seek for new agents, which may attack some types of tumors. Even though cisplatin is used to treat the disease, it shows a wide number of side effects and a limited spectrum of activity. The main goal of this project was to prepare a new platinum(II) complex with two ligands of known biological activity. The structurally related ligands 2-(4-thiazolyl)benzimidazole (tb) and 2-mercapto-1-methylimidazole (mimt) were used to prepare a new complex with formula [PtCl₂(tb)(mimt)] NO₃. The precursor [PtCl₂(tb)] complex was prepared by the direct reaction of an aqueous solution of K₂[PtCl₄] with an ethanol solution of tb. Then, [PtCl₂(tb)] was reacted with silver nitrate, followed by the addition of mimt. The crystalline product was characterized by elemental analysis, and Raman, infrared and ¹H-NMR spectroscopies. The elemental analysis of the complexes confirmed the formula [PtCl₂(tb)(mimt)]NO₃. The IR spectra demonstrated the mixed-ligand nature of the complex: vibrations due both tb and mimt were present. The proton signals of the tb and mimt ligands were assigned, and all proton signals are shifted downfield due to coordination to platinum. The Raman and IR spectra were useful in the characterization of Pt-S and Pt-Cl bonds, and also confirmed the presence of ionic nitrate. The spectral studies confirm that the synthesis was successful, and the structural characterization of the new complex will be pursued by X-Ray analysis of a single crystal.

P11
ISOLATION AND CHARACTERIZATION OF PHOTOSYNTHETIC PURPLE NON-SULFUR BACTERIA (PPNSP) OF THE HYPERSALINE MICROBIAL MATS FROM THE CABO ROJO SALTERN
Moisés De Jesús-Cruz, Kristina Soto-Feliciano and Carlos Ríos-Velázquez
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Microbial mats have been described as stratified communities that are developed at the interfaces between the water and solid substrates in extreme environments. These contain an organosedimentary-laminated structure, which is divided by a gradient of the light, dissolved oxygen and sulfide. In their fully developed state; microbial mats are composed of three different layers. The top layer (green) is made up of organoheterotrophic cyanobacteria and other aerobic bacteria. The central layer (pink) is characterized for the presence of anoxygenic phototrophic bacteria; among these we can find green and purple sulfur and non sulfur bacteria. Sulfate-reducing bacteria compose the layer at the bottom (black layer). This research focuses on isolating and characterizing cultivable and non-cultivable Purple Non Sulfur Bacteria (PNSB) present in young and mature mats from two different sites of the Cabo Rojo Salterns, during rainy and dry seasons. The studies of the microorganisms isolated from the pink layer are going to be characterized morphologically, physiologically and molecularly. Microbial mats were dissected and the pink layer was cultivated in solid and liquid media. After being incubated anaerobically in the presence of light a characteristic reddish bloom was observed, and the colonies with PNSB pigmentation were isolated and characterized microscopically, biochemically and molecularly. A total of 10 candidates of the rainy season and 13 candidates of the dry season were isolated. Microscopic analysis revealed gram-negative rods of variable size in both groups of candidates. Biochemical and molecular analysis revealed the presence of the bacteriochlorophyll peaks (800 and 850nm). Amplicons from all the isolates were obtained using specific primers for pufM and 16S rDNA. In silico analysis suggests the presence of Rhodospirillaceae bacterium, Rhodospirillum salexigens and various unidentified species in both mats. Future studies will be focused on restriction analysis of pufM, a gene involved in photosynthesis.
P12
ECOLOGICAL DIVERSITY OF TANAIDS AT CULEBRA ISLAND, AND AT LA PARGUERA, PUERTO RICO
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A temporal and spatial characterization of Tanaids, Crustacea, Peracarida) was done in response to the installation of two cages for open ocean fish culture placed 28 m deep and located 3.2 km south of Isla Culebra, and samples taken at La Parguera, Puerto Rico. Bimonthly sediment samplings were obtained in the north, south, east, west and at center sites under each cage and in a control site at Isla Culebra and samples from different Keys of La Parguera were also obtained. This study found an increment in abundance of tanaidaceans and numerical dominance of this group over other infaunal invertebrates during months when feeding rates increased significantly and during the harvest periods, and a higher abundance of this group was also found towards the center of the cages. Currently, there is limited information about the taxonomy composition of tanaidaceans in the neotropics. The species Saltipedia (Spinosaltpedia) puertoricensis, a new subgenus and species of apseudomorphan (Crustacea: Tanaidacea: Parapseudidae) from the coastal waters off Culebra Island was recently described and three new species of Tanaidomorpha (Crustacea: Peracarida: Tanaidacea) from this sampling effort were found and are in the process of identification.

P13
EFFECT OF THE PRESENCE OF BLUE GREEN ALGAE ON CHLOROPHYLL A IN LAKE GUAJATACA, LAKE LA PLATA AND CARTAGENA LAGOON IN PUERTO RICO
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Planktonic chlorophyll a was analyzed ex situ from the Lake Guajataca (Quebradillas), Lake La Plata (Dorado), and Cartagena Lagoon (Lajas), in order to evaluate its correlation to cyanotoxin and blue green algae concentrations. These body waters were sampled through January to March 2010. Factors, such as phytoplankton density, toxins, nutrients and climatic conditions, were variables that affected the concentration of chlorophyll a. The blue green alga, Microcystis aeruginosa, which produces a cyanotoxin named microcystin, was identified from all three localities. Cyanotoxins and nutrient concentrations were determined at the Agriculture Experiment Station (UPR-Rio Piedras). Eutrophication (nutrients) was positively correlated with chlorophyll A and M. aeruginosa concentrations. Future study is required to analyze the microcystin at a molecular level, and to identify the possibility of cell recognition through the insertion of the gene that produces this toxin in a virus. Special acknowledgments are expressed to Bio-Minds Program, and Dr. Carlos Santos Flores, for support in this research project.

P14
ENRICHMENT OF ELECTRICITY PRODUCING MICROBES USING GRAPHITE ELECTRODES
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Microbial fuel cells are systems that can be operated based on the ability of specific groups of bacteria to oxidize organic matter and mediate the transfer of electrons through electrodes. These microorganisms are known as electricigen and are commonly associated with anoxic sediment environments. Nevertheless, knowledge on their diversity and function is still limited. To our knowledge, environmental strains of bacteria with this capacity have not been studied in Puerto Rico and the broad biodiversity associated with tropical environments holds great promise for uncovering novel cultures with the potential for developing alternative energy sources. We have prepared microbial fuel cells using graphite electrodes to test their usefulness as an enrichment device for environmental electricigen. Our set up consisted of a an experimental system and two control cells, each of them with their respective anodes incubated in a fresh-water sediment mesocosm. A functional experimental cell was prepared and is expected to enrich for organisms capable of carrying out a sustained electric current by using the anode as an electron acceptor. Additionally, two control cells, one with unattached electrodes and another with insulated electrodes were also prepared. The latter two are expected to provide a surface for the attachment of microorganisms regardless of their ability to produce electricity and serve as references relative to the experimental cell. Incubation experiments of the cells are in progress. We expect to characterize the community associated with the anodes with DNA based methods to obtain a comprehensive vision of the dominant groups and their relationship to known electricigen.
P15
THE PRODUCTION OF CHLOROPHYLL A BY BENTHIC ALGAL COMMUNITIES IN RIVERS OF PUERTO RICO
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This study is to determine the level of contamination in rivers of Puerto Rico by measuring the production of chlorophyll a by some specific algae. With this study we will be able to know which algae are the most abundant in the rivers and how this is related to the level of contamination. For this study we have chosen some of the rivers less impacted by humans, which are Bosque Sonadora, Bosque Olimpia, Mameyes and San Virón.

Our goals are to calculate the amount of chlorophyll a produced by different type of algae in the rivers selected. With these results we can then estimate the relationship between the amount of chlorophyll a produced and the type of algae in that river. This information will help us protect aquatic life from the effects of nutrient overenrichment determining numeric nutrient conditions in each river.

Having the samples in the laboratory we prepared sample slides, after the bottles were shaken 25 times approximately, and placing it on Sedgewick-Rafter chambers. Then these samples were examined. From these samples, we identified different types of filamentous algae, cyanobacteria, diatoms, euglenophytes and green algae. After this we need to determine the amount of chlorophyll a produced by these algae to know the effect they have in the river. The numeric nutrient criteria were reported by other members of the project.

Most of the algae identified were diatoms (Cymbella, Fragillaria and Synecladus). From the nutrient analysis we considered nitrogen, organic nitrogen, nitrate, phosphorus, dissolved orthophosphate and ammonia. The analysis revealed that the most abundant nutrient is NO₃ with a concentration of 27.672 mg/L for all sampling stations from 1990 to 2009. The second most abundant was total nitrogen-total phosphorus with a concentration of 23.852 mg/L.

The abundance of diatoms in a river is indicative of high levels of phosphorus. Green algae and cyanobacterium use dissolved nitrogen for their metabolism. Depending on the alga more abundant in the river is the nutrient that is in more concentration. Knowing the type of algae more abundant in the river we can then determine which nutrient is in excess causing eutrophication and therefore be able to clean the river.

We express our deepest gratitude to Dr. Carlos Santos for being my mentor and guide through these semesters. All the personnel who participated in analyzing the nutrients in these rivers and providing the numeric data.

P16
ISOLATION OF SPECIFIC TOXIN COMPONENT RECOGNITION PEPTIDES USING PHAGE DISPLAY
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Phage Display technology has matured to the point where it is now a powerful tool in the post-genome era. Phage Display constructs of genetically tagged peptides and protein fragments allow the generation of pools of combinatorial nucleotides, mRNA’s or fragmented genomes into populations of viruses that contain the nucleotides coding for the elements that are displayed on their viral surfaces. The main focus of this project is to use T7 phage display technology to map and isolate possible interacting partners of the highly specific lethal factor, a component of the tripartite protein toxin secreted by Bacillus anthracis. The display of human cDNA fragments on the surface of T7 bacteriophages has successfully been used to identify candidates interacting proteins, from purified wild and mutant lethal factor as target. Phages clones displaying putative toxin specific peptides were isolated after several rounds of affinity selection and the cDNA amplified by PCR. The products from amplifications where sequenced and analyzed In silico using available nucleic acids and protein databases. Preliminary data suggest consensus with 3h3 protein, which takes place on embryogenesis bones development. Actually more candidates were sent to be sequenced and perform In silico analysis.
P17

SORPTION OF XYLENE ONTO CRUMB RUBBER FROM GAS PHASE

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Waste tires represent a serious problem to the environment and public health due to the great quantity discarded yearly. New ways of disposal and applications can be devised to reduce the impact of this waste in the environment. Tire crumb rubber (TCR) shows sorption properties that could be potentially useful for the removal and recovery of volatile organic compounds in gaseous media. The removal of xylene in gaseous phase using the sorption properties of TCR was evaluated. TCR mesh 14-20 (25.0 g) was packet in a stainless steel column. Xylene was injected with at a rate of 30 µL/min in an air flow of 50 mL/min. The xylene was sampled with a gas tight syringe and quantified by GC-MS. The results confirm that xylene in gaseous phase can be sorbed and desorbed onto TCR which represents an alternative use for recycling tire rubber. Sorption and desorption experiments at different pressures will be used to construct sorption isotherms.

P18

CHARACTERIZATION OF DIESEL, BIODIESEL AND MIXTURES OF THEM WITH MULTIVARIABLE ANALYSIS METHOD

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Fourier Transform Near-Infrared (FT-NIR) and Raman spectra were obtained for samples of Diesel, Biodiesel, and their mixtures (10, 20, 30, 40, and 50% of Biodiesel-Diesel). Multivariable analysis of the spectra was performed to develop a method for analyze unknown biodiesel samples. The mixtures were prepared with concentrations of 10, 20, 30, 40, and 50% and two other samples of pure Diesel and Biodiesel were used too. The FT-NIR and Raman equipment were used using the following conditions: for FT-NIR, 8 cm⁻¹ of resolution and a setting of 128 scans; for Raman, different exposure time and accumulation were used. For both equipments triplicate spectra were obtained for the samples. The obtained spectra were analyzed with the Pirouette software (Infometrix, Bothell, WA). Some results were founded interesting like the fact of the Biodiesel spectrum always is opposite to Diesel spectrum. To the data was applied PCA and PLS, between others pretreatment done to the data. This study allows an easy identification and quantification of Biodiesel/Diesel samples. The techniques used are feasible because it is a non-destructive analysis, fast and easy to use, does not require sample preparation for the analysis, and is environmental friendly (does not require the use of reagents).

P19

HOT MELT EXTRUDED BIOPOLYMERS AS NANOPARTICLE CARRIERS FOR DRUG DELIVERY PURPOSES

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Biodegradable polymers are suitable materials for many medical applications, including pharmaceutical drug and gene delivery, orthopedics, and wound dressings. Particles can add valuable properties to the biodegradable polymers, obtaining multifunctional nano composites or serving as on stable carrier. But even so, particle shape and concentration may affect polymer behavior and performance causing an undesired effect. In this work, we studied the effect of 0.5µm spherical silica particles, in the concentration range between 0 to 1wt%, on the performance of melt blended hydroxypropylcellulose films, with polyethylene glycol as plasticizer, and a resin of gelatin (Bovine Type B), and glycerol. The thermal and rheological properties as a function of processing conditions determined in a Rheologica StressTech HR rheometer and a TA Q-2000 differential scanning calorimeter will be presented. The morphology of the films was also determined by SEM.
This project addresses the need for renewable energy by developing technologies for controlled growth of microalgae as a cost effective source of various oils that serve as starting materials for Biodiesel and Biojet fuels. The integrated Biorefinery technology platform utilizes carbon dioxide produced during bioethanol fermentation as the carbon source for microalgae growth and capitalizes on the long photoperiods in Puerto Rico by using fiber optic delivery of sunlight. Molecular genetics and analytical expertise are being used to characterize unique indigenous microalgae and to optimize the production of different oils desired for manufacturing different Biofuels. The main technical objective of this project is the Identification and Characterization of Microalgae to Increase the Yield of Suitable Oil for the Production of Biojet Fuel.

Ethanol produced from lignocellulosic biomass resources is a fuel with potential to match the convenient features of petroleum, and to substantially reduce the emissions of greenhouse gases when compared to fossil fuels. Mathematically modeling profile concentrations of cells, substrates and products in biomass-to-ethanol fermentation processes allows to predict in a systematic way the trends that concentrations will follow, quantifying the amounts produced and depleted, being an important tool for process control, optimization and economics. The vision of this project is to determine fermentation kinetics and to model both single systems and mixtures of glucose-xylose, using the wild-type yeast strains Saccharomyces cerevisiae Montrachet and Pichia stipitis NRRL Y-11545 in various batch experiments performed in agitated flasks under hypoxic conditions, with the subsequent data analysis, optimization and simulation of profile concentrations. Results obtained in experiments comprising of only one sugar and one yeast strain were used for single substrate simulations using the Monod unstructured model, and also for the construction of the cybernetic structured model describing the behavior of sugar mixtures. Proposed models fitted accurately experimental data in all cases, with residual standard deviations below 10% and linear correlations above 95% for the majority of predictions. In general, the cybernetic framework provided great results in efforts to model multisubstrate co-fermentations systems and its application to a mixed culture was successfully proven, which suggests that the present co-culture scheme is adequate for batch bioethanol production; fed-batch and continuous configurations can be carried out in the future to analyze the application of cybernetic model, using also an immobilized scheme for the microbial co-culture. This work has provided a meaningful contribution to the fermentation modeling area since it is one of the few works in course where the cybernetic model is also applied to mixed cultures. This work was performed with funds received from the first grant of BioSEI and the UPRM R&D Center, seed funds from Sustainable AgBiotech (SABI) and collaboration from the Industrial Biotechnology Program.
P22
REMOVAL OF TOLUENE ON GASEOUS PHASE USING TIRE CRUMB RUBBER
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Toluene is present in gasoline, cleaning products and petroleum. It is considered a water and gas contaminant by the Environmental Protection Agency (EPA). Also, waste tires have become a serious contamination problem in Puerto Rico and worldwide. For those reasons we want to design a methodology to make possible the removal of toluene using tire recycled crumb rubber. Tire crumb rubber (TCR) mesh 14-20 (≈25.0 g) was packed in a stainless steel column. Toluene was injected with at a rate of 30 μL/min into air flow of 50 mL/min. Toluene in gaseous phase was sampled using a gas tight syringe and quantified by GC-MS. The capacity of TCR to remove toluene was achieved. TCR got saturated approximately after 9 hours of contact. Desorption of toluene was observed after saturation which indicates a possible reuse of the sorbent and recovery of the adsorbates. For future works we will analyze absorption and desorption isotherms.

P23
RAMAN SPECTROSCOPY TO MONITOR CELL METABOLISM, APOPTOSIS AND APOPTOSIS INHIBITION IN SUSPENDED CHINESE HAMSTER OVARY CELLS CULTURES
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The productivity of suspended mammalian cell cultures plays a major role in the overall manufacturing costs of biotechnology products. Upstream cell culture product variability can lead to problems in downstream purification and even in the quality of the final product. Amino acids and carbohydrates are the major raw substrates of mammalian cell metabolism. Understanding the ways in which the cells use these nutrients, researchers can gain a better understanding of what factors contribute to productivity, variability and apoptosis in cell culture processes. To achieve this understanding, Raman spectroscopy can be used to develop a non-invasive, in-line tool to monitor and better understand the mammalian cell growth process in real-time. Our work is focused in implementing this analytical method as a way to monitor cell metabolism and death off-line for different culture conditions, such as two different temperature set points and presence in the culture medium of an apoptosis inhibitor (Cytochrome C inhibitor). Techniques such as Pico-green dsDNA assays, ELISA, HPLC and biochemical analyzers will be used as reference methods to validate the Raman spectra as a routine measurement in commercial cell culture processes. It is expected that the implementation of this methodology in-line will result in a better comprehension of mammalian cell culture in real-time and an improvement of productivity in such systems, as well as a tool towards PAT implementation. Eight Batches were performed with four different conditions. The best parameters were a Temperature range of 35-33 C in 2.5 days with over-expression in the media of the Apoptosis Inhibitor. In this case, twelve run days were achieved with viability between the nineties and eighties percent with a substantial increment in L-lactate as a secondary metabolite and a constant cell density on the entire runs. For conditions of Temperature range of 37-33 C in 2.5 days and over-expression of Apoptosis the data obtained shows that even though a higher viability was also achieved, but run days were not extended and the increment of L-Lactate was also observed. The Raman proposal for monitoring cell metabolism and apoptosis was studied and great results for cell metabolism were achieved. In the matter of the apoptosis is still in study and analysis.
Our investigation focuses in the behavior of Hb I with regard to its affinity to H₂S to develop a biosensor to detect H₂S. Electrochemical analyses were done on recombine hemoglobin of Lucina pectinata (rHbI) using cyclic voltammetry. The rHbI was attached to the surface of Au electrode after modifying the surface using cysteine, 3-mercaptopropionic acid and Ni 2+. During the modification process of the Au electrodes, cyclic voltammetry was used in order to assure proper modification after each step. The current obtained for both modifications (using cysteine and 3-mercaptopropionic acid) was reduced. This demonstrated that the surface is modified complicating the transference of electrons generated by the change in potential of the redox groups. The cyclic voltammetry realized at different scan rates demonstrates the effective attachment of the protein to the surface.

Enzymatic hydrolysis of cellulose is an important process by which enzymes are used to break down cellulose into sugar. Cellulose is the structural component of the primary cell wall of green plants and is a polymer derived from D-glucose units, which condense through β (1→4)-glycosidic bonds. Hydrolyzing this complex polymeric structure into fermentable sugars is essential to the efficient and economic production of cellulosic ethanol; an alternate biofuel, with the potential to reduce green house gas emissions and fossil fuel dependence. This study was conducted to determine the kinetics and hydrolysis yields of Trichoderma reesei cellulases (ATCC 26921, strain C-8546) by means of Michaelis-Menten model, to obtain the best hydrolysis conditions. Hence, batch hydrolysis reactions for energetic sugar cane bagasse and SigmaCell cellulose (S-5504) were studied at constant temperature and agitation speed of 45°C and 200 rpm, respectively. The hydrolysis reactions were performed in an acid medium (pH 5.0) of 0.1M sodium-acetate buffer using biomass concentrations and cellulases concentrations of 5.0 (%w/100mL) and of 0.25 mg/mL, respectively. The glucose released was determined by means of periodical enzymatic biochemistry analysis. Under these conditions, the energetic sugar cane bagasse and the SigmaCell cellulose were degraded 9.35% and 19.69%, respectively. Based on data analysis, the hydrolysis yield for both reactions were substantially low, therefore, the results suggest that in the enzymatic reactions emerged inhibitions. Ultimately, in order to optimize the cellulose hydrolysis the energetic sugar cane bagasse biomass will be employed in subsequent kinetic studies, in which the substrate concentration will be manipulated; with the aim of characterizing the Trichoderma reesei cellulases and to perform simulations with mathematical models obtained. This work is being conducted with the support of BioMINDS, an undergraduate research program supported by the Amgen Foundation.

In this work we studied the thermochemistry on gold nanoparticles. Gold nanoparticles are effective catalysts for the oxidation of CO, CH₄ and NO, hydrogenation of acetylene, epoxidation of olefins and ozone decomposition. We used periodic density functional theory (DFT) calculations to study adsorption of atoms and molecular species on the surface of Au(111). The best binding sites, binding energies and configuration of the species were determined and the energies obtained were used to probe surface reactions.
**P27**

SYNTHESIS AND CHARACTERIZATION OF SILICA PARTICLES AND SILICA CONTAINING POLYMER SOLUTIONS

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Monodisperse silica particles can be synthesized using the Stöber method which consist of the reaction of ammonium hydroxide (20-30% of NH₃ in H₂O) ethanol (or any low molecular weight alcohol) and tetraethylorthosilicate (TEOS). These synthesized silica particles can have a range from 5 to 2000nm. Using this procedure we synthesized silica particles by variation of the concentrations of the reagents. Particle sizes where measured using the dynamic light scattering which showed different particle sizes for each solution demonstrating that the concentration of reagents affects directly the size of the silica particles. A Zeta Potential Analysis showed that the silica particles have a negative charge on pH 2 -10 but are more stable in the pH range of approximately 6 to 8. Sodium alginate is a natural biopolymer which is used to increase viscosity and can be used as an encapsulation polymer, among other things. The gelation temperature of sodium alginate solutions was studied as a function of silica particle concentration to determine if it is a viable candidate for producing drug releasing films. Constant-stress temperature ramp tests were performed in a Reologica StressTech HR rheometer.

**P28**

SUPERCRITICAL FLUID PROCESSING AND IMPREGNATION OF PHARMACEUTICAL DRUGS

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Cancer affects people at all ages with the risk for most types increasing with age. Cancer caused about 13% of all human deaths (7.4 million) per year. Predominant types of cancer are: lung cancer, stomach cancer, colorectal cancer, liver cancer and breast cancer. In fact, one of three people will develop cancer during their lifetime. The research goal is to use supercritical fluids to encapsulate pharmaceutical drugs. The main motivation for this research was the possibility of exploiting the peculiar properties of supercritical fluids and in particular of supercritical carbon dioxide (CO₂), the most used supercritical fluid for precipitation processes. In the case of carbon dioxide, the supercritical region can be achieved at moderate pressures and temperatures (Tₑ=304.2 K, Pₑ=7.38MPa); therefore, working with supercritical fluid CO₂ it is possible to carry out the process at near-ambient temperatures. Those properties convert the CO₂ supercritical in the most appropriate supercritical fluid for the encapsulation process. Additionally, the use of the supercritical fluid eliminates or reduces the use of toxic or contaminant organic solvents in the process. Also, the high solubility of most organic solvents in supercritical fluids allows obtaining solvent-free products. The final objective of this research is finished with a more selective pharmaceutical drug increasing the percent of efficiency. The nature of drugs and encapsulating agent determines the characterization methods to be used, several properties commonly characterized are: particle size distribution, release rate of the encapsulated drug and degradation of the carrier material. The materials used were Acetaminophen, Compritol 888 and Fluorouracil. Acetaminophen and Fluorouracil were the active agent and compritol 888 the encapsulating agent. Some techniques that I used during this research are DSC and solubility tests. DSC analysis confirmed that the product is simply a mixture of segregated particles of active substance and carrier. Solubility tests helped to determine the solvent that does not dissolve the drug and encapsulating agent With the DSC it was found that the drug does not encapsulate manually (by means of agitation and mixing 50% active agent and 50% encapsulating agent with ethanol) because of comparison between the graphs of the active agent and encapsulating agent individually with the mixture of both. This allowed to obtain the same results (since there was no change in C_p). The solubility test showed that water is a perfect solvent because it does not dissolve Acetaminophen not Compritol 888 but it also showed that it’s not appropriate to mix with CO₂. In the other hand ethanol is perfect to use with CO₂ but not with Acetaminophen (because it’s soluble in ethanol). Finally, processing natural and pharmaceutical substances with supercritical fluids has many advantages: non-toxicity related and easy removal of the solvent, operation at moderate temperatures and in an inert atmosphere that allows avoiding degradation of the product, among many others. Futures goals for this investigation are: to find an appropriate solvent to encapsulate the drug that do not affect the mixture but also don’t hurt people that consume the drug, begin to use supercritical fluids and lastly, obtain positive results to begin to use anticancer drugs. Once we begin to encapsulate drugs, it’s important to test them with DSC, SEM, XRD and TGA. I have to be grateful with Dr. Suleiman Rosado Maldonado and BIOMinds since they have helped me greatly in the elaboration of this research.
P29
SYNTHESIS AND STUDY OF COMPOSITE LIQUID CRYSTALLINE ELASTOMERS
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Recently, liquid crystalline elastomers have shown to have many potential uses in a wide range of applications, from diagnostic materials to artificial muscles. Of special interest are composite liquid crystalline elastomers, which is a ground-breaking field in rheology. Without a doubt, their study will escalate the amount of currently-known potential applications. In this work, a route for the synthesis of composite side-chain nematic liquid crystalline elastomers is being developed via the copolymerization of a mesogenic monomer with structure directing cross-linking agents. In addition, the mechanical properties of such composite elastomers will be studied at different temperatures and under the application of shear and external (i.e. magnetic or electric) fields.

P30
SCREENING FOR DNASES AND OTHER BIOACTIVES MOLECULES WITH BIOMEDICAL IMPORTANCE FROM METAGENOMIC LIBRARIES AT TROPICAL AND DRY FORESTS IN PUERTO RICO.
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Metagenomics, is a new discipline in biosciences capable of having access and studying microorganisms that are unable to grow in laboratory conditions; 99% of the species belong to this category. Functional metagenomics allows us to test for activities in cultivable hosts which have environmental DNA cloned. This is a powerful research tool for the discovery of bioactive molecules with medical & industrial applications. Antimicrobial agents, proteases & lipases are some of the activities that can be monitored using metagenomics. The forests are excellent environments and resources for the discovery of new microorganisms with bioactive capacities due to their degree diversity.

The main purpose of the research is to monitor a tropical and a dry forest in Puerto Rico, for DNase activity. DNase is an enzyme that breaks down molecules of DNA, and a powerful tool for scientists in Genetic Engineering, and Molecular Genetics. The selection tool being used is the DNase Test Agar with Toluidine Blue (TBA). A positive clone will turn pink the media creating a pink halo around the colony. By using serial dilutions, approx. 1000 clones from the forests metagenomic libraries sub-pools were spreaded on TBA, and incubated at 37°C. Serratia marcescens was used as a positive control. The metagenomic libraries have approximate 800,000 clones, distributed on 40 different sub-pools. A total of five sub-pools approx. 50,000 clones have been already screened under standard conditions without finding a positive clone yet. There are ongoing experiments to complete the rest of sub-pools.
A mayor problem during the 20th and 21st century is growing demand of fossil fuels and the contamination resulting from the use of these energy sources. Alternatives to solve this problem are the use of renewable resources of energy that are more environmental friendly. Bio-fuels are energy sources that have promising future as substitutes of fossil fuels. Ethanol is one of the more promising biofuels that is being used as a substitute for fossil fuels in countries like Brazil, but its production has not yet achieved its maximum potential, due to the impact of diverting crops and farmland to its production, and several other factors. In this work we are studying the use of sugar cane bagasse as a raw material with the goal of reducing the use of food sources as bio-ethanol sources. We are characterizing the different parameters that characterize the biomass saccharification kinetics of xylanase and hemicellulase, enzymes obtained from the fungi Trichoderma viride and Aspergillus niger. These enzymes have a very good potential for the hydrolysis of the hemicellulose fraction present in the sugar cane bagasse. In this work, we will report on the characterization of the enzyme hydrolysis kinetics for systems consisting of sugar cane bagasse as substrate, under the reaction conditions of 45°C, 200 rpm, and 100 mL of 0.02 N citrate buffer with an initial pH of 4.8. The long-term goal of this work is to use these enzymes as part of a cocktail of enzymes that will be used for the development of a bioreactor where simultaneous hydrolysis and fermentation of sugars will take place. This work is being conducted with the support of BioMINDS, an undergraduate research program supported by the Amgen Foundation and AMP, an undergraduate research program sponsored by NSF.

Neuron cells are at the core of the neural system. Brain messages pass through these cells initiated by the action of the neurotransmitter, Acetylcholine (ACH), which activates the ligand-gated ion channel followed by the intake of Na+ and Ca2+ cations. Damage to the nervous system, caused by an interruption of blood flow, known as a stroke, breaks the neuron continuity pathway, which in turn loses the message passing through the neurons at that spot. Multiple studies have been performed as an effort to develop new techniques to remediate the brain damages caused by a stroke. Brain implants have been inserted into mammals to read nerve signaling and re-route it to the extremity that will perform it in the appropriate order. CNTs also have been used to improve the neural signal transfer because obtained results suggest that they allow the growth of neuronal circuits on the CNTs grip accompanied by an increase in the network activity.

We had observed the formation of silver nano-structures over death brain tissue. And one-dimensional nanowires were form using silver nano-structures has precursor. Our purpose is to create a method where we are able to install a nanometer size implant using multiwalled carbon nanotubes. Throughout these, Na+ and Ca2+ ions can flow sending the action potential in the way that acetylcholine could be released, allowing messages between neurons to pass. We plan to fix the carbon nanotubes to the cerebral cell using phospholipids. We create silver carbon nanowires over death cerebral tissue and one-dimensional nanowire was form from silver nano-structures. With this assumption we can move forward to the experimental part of the project where we can prove or discard our theory.
P33
MICROALGAE HARVESTING BY APPLICATION OF AN ULTRASONIC FIELD
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Alternatives to petroleum sourced fuels have become a high priority due to the diminishing amounts of currently known sources. Biodiesel produced from oil extracted from microalgae is a promising option. This biofuel is generated by means of a transesterification, which can’t be carried out in the presence of water due to soap formation. For that reason, methods to harvest microalgae (separate cells from its broth) by application of ultrasound in the sonoluminescence equipment are being studied. From Bosma et al. microalgae were harvested applying waves of high frequencies (order of MHz) and low amplitudes. Since our equipment does not have the capability to reach such high frequencies (maximum frequency is 59.999 kHz), other factors like the pH and concentration of microalgae solution that can also affect the separation are being explored. Currently, our experiments are searching for the optimum conditions of pH and concentration in which the microalgae S. ovalternus (Scenedesmus ovalternus) and S. costatus can be harvested using frequencies in order of kHz and low amplitudes. The experimental results demonstrated better microalgae sedimentation at higher alkalinity and cells concentration. Moreover, the separation process is more effective with S. costatus than S. ovalternus. On the other hand, the future studies about this separation method will consider other operational conditions such as: performing these experiments in acidic medium, applying an electric potential or on other types of containers in which all the sample is exposed to the ultrasonic field to discard the possibility of microalgae sedimentation caused by diffusion. Lastly, the development of this research project is possible thanks to the support of the United States Air Force, BioMinds and Puerto Rico Louis Stokes Alliance for Minority Participation.

P34
NEURON-TARGETING MAGNETIC IRON OXIDE NANOPARTICLES AS A NON-INVASIVE TOOL FOR THE STUDY OF NEUROMUSCULAR JUNCTION DEVELOPMENT IN DROSOPHILA
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The neuromuscular junction, responsible for muscle contraction, is the synapse between the motor neuron axon terminals and the muscular fiber. During embryonic development and prior to synapse formation, the muscle extends actin based fibers called myopodia which direct the neuron to its corresponding site in the muscle fiber. Although this physical process is well understood, much remains to be elucidated about the signaling that occurs between neuron and muscle fiber; that is, whether the neuron signals its corresponding muscle fiber site to extend a myopodia or whether the myopodia directs the neuron. In order to study this, we have developed magnetic fluorescent nanoparticles coated with antiHRP that target HRP expressed in neuron’s membrane. In this way, an applied external magnetic field can pull the neuron toward a desired site in the muscle fiber. This provides a non-invasive tool to study neuromuscular junction development. To do this, we synthesized iron oxide nanoparticles by the co-precipitation method, coated them with an amino terminal silane ligand and covalently attached an Alexa fluorophore and carboxymethyl dextran via carbodiimide activation. We then attached biotin, and quantified it to eventually graft one biotin molecule per nanoparticle cluster. Finally, we incubated biotin coated nanoparticles to previously prepared streptavidin-antiHRP, leading to nanoparticle/biotin-streptavidin-antiHRP conjugation. Biotin quantification results have allowed determination of reaction conditions necessary for grafting one biotin molecule per cluster. Dynamic Light Scattering measurements have shown a significant increase in size after incubation with streptavidin-antiHRP, implying successful conjugation. Finally, preliminary confocal microscopy images in Drosophila larvae show colocalization of nanoparticles at desired neuronal sites, suggesting nanoparticles targeting ability. Once this preparation method has been fully developed, it can easily be extended to a wide range of antibodies that target specific neurons or sites in the developing neuromuscular junction.
P35
SURFACE-ENHANCED RAMAN SPECTROSCOPY FOR THE DETECTION OF NUCLEOTIDES, NUCLEOSIDES AND NITROGEN BASES OF DNA AND RNA AT SUBMICROMOLAR LEVEL
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Surface-Enhanced Raman Spectroscopy (SERS) is a surface sensitive technique that results in the enhancement of Raman scattering by molecules adsorbed on rough metal surfaces. This research is intended to optimize a method for the study of nitrogen bases to be analyzed by means of the Spectroscopy of Raman (SERS) and thus achieve standardization. First, silver nanoparticles were synthesized and monitored over the time for decomposition. Changes in the synthesis procedure were done to verify the conditions that could affect the growing of the nanoparticle. Ultraviolet spectroscopy was used to detect the nanoparticles. Adenine was adsorbed on the surface, and SERS spectra were obtained for the different colloids to determine the most efficient synthesis method. In the future, other nitrogen bases, nucleosides and nucleotides will be studied to standardize a method for the analysis of these biomolecules using SERS techniques.

P36
THE DNA APTAMER VEa4 AND ITS ASSOCIATION TO THE VEGF_{165} PROTEIN
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Vascular endothelial growth factor (VEGF) is crucial for cellular division, and can function as a “death” signaling device. Abnormalities within its protein structure by denaturalization or mutation can induce the cells to undergo apoptosis or programmed cell death. VEGF serves as an antigen for antibodies or aptamers, and these interactions play an important role in chemotherapy treatments for different types of cancer. One of the DNA aptamers found for VEGF, VEa4, binds to one of the VEGF isoforms called VEGF_{165}. This aptamer is the focus of our research because specifically binds to VEGF_{165} and the only secondary structure known for this aptamer is based on computer modeling. A VEa4 stock solution was prepared and diluted with buffers at different concentrations of salts. Changes in the procedure were made for the refinement of the results. The predicted secondary structure for this aptamer was confirmed by UV spectrophotometry. The data obtained was used on a graph where sigmoid curves provided the melting temperature values for the aptamer at different salt concentrations. PBS with 1 mM of MgCl$_2$ and Tris buffer with 50 mM or 100 mM of NaCl are the optimal conditions required for the future study with the circular dichroism technique. We want to acknowledge the BioMinds Program, sponsored by Amgen, PR, for the funding support through this academic year 2009-2010, the Department of Chemistry, and the laboratory peers.

P37
EXPERIMENTAL AND DFT STUDY OF THE MECHANISM OF ACETONE-PEROXIDE FORMATION REACTION
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A mechanism for the uncatalyzed reaction between acetone and hydrogen peroxide leading to the formation of the important homemade explosive acetone peroxide (AP) is postulated. The proposed mechanistic scheme is based on Raman and nuclear magnetic resonance spectroscopies measurements and is also supported by ab-initio density functional theory (DFT) calculations using B3LYP method with 6-311g**d++ basis set. It was found that for the uncatalyzed reaction, the proposed mechanism of cyclic organic peroxides formation occurs in three steps: monomer formation, polymerization of the 2-hydroperoxypropan-2-ol monomer and cyclization. Calculated rate constants proved to be in agreement with theoretical calculations. The activation energy obtained confirms that the polymerization step is favored in comparison to other possible pathways. In fact, the activation energy is twofold lower than the acetone-monomer reaction and the peroxide-monomer reaction according to experimental and theoretical measurements.
By implementing reduced dimensionality models, termed coarse-grained, the thermodynamical properties of various biomolecular systems were computed. Specifically, a lipidic bilayer composed of DPPC molecules was prepared, and a well-known interparticle potential implemented. A newly developed method with constant number of particles, temperature, and surface tension coupled to replica exchange Monte Carlo was implemented. The equilibrium structure of the bilayer was obtained for zero surface tension and various temperature. Another system that was considered was composed of spherical biomolecular systems adsorbed on an electrode surface. Using replica-exchange Monte Carlo in the canonical ensemble, caloric curves were obtained for the desorption process of the molecules. A detailed mechanism is proposed for different surface interparticle potentials.

This research is driven by the need of creating standards that provide an effective way of detecting and quantifying explosives that may represent threats to people. They have to be deposited on substrates in trace amounts. We took advantage of the multiple benefits that Fiber Optic Coupled Infrared Spectroscopy offers to identify materials, in our case explosives, and used it to develop new methodologies to achieve the main purpose of this project. The methodology consists in a Grazing Angle Probe rendering the latter as a remote sensed and in situ method of detecting micrograms/cm² of the compounds and used chemometrics for data analysis. A smearing technique was used to transfer the target analytes and threat agents to the substrates. Recent work centered in to obtaining the spectra of TNT, DNT and PETN and the behavior that they present when deposited on glass at different concentrations. The multiple spectra collected showed that explosives can be detected and quantified. The quantification was done by PLSI methodology, an efficient approach to detect and quantify threat chemicals deposited on glass surfaces. Calibration curves for different explosives were obtained and cross validation, regression coefficient and error estimation were used for evaluated of models developed. The detection limits were dependent on sublimation pressure of the explosive and the error of prediction.
P40

SAA2 INTERACTIONS WITH PROTEINS EXPRESSED IN ACTIVATED MACROPHAGES

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Serum Amyloid A (SAA) is an acute phase protein with an approximately molecular weight of 12 kD that is expressed in adipocytes, macrophages and neutrophils. There are four isoforms of SAA in human: SAA1, SAA2, SAA3 and SAA4. The isoforms SAA1 and SAA2 are the most known and are denominated acute phase proteins. Preliminary studies have reported that after induction with dexamethasone and lipopolysaccharides, the concentration of SAA can increase from 100 to 1000 fold, thus causing the displacement of serum proteins from the HDL complex incorporated in the blood stream. A change in the secondary structure as well as the tertiary structure of SAA causes its deposition as fibrils in many organ tissues and as a consequence, SAA has been implicated in human diseases such as amyloidosis, cancer, and rheumatoid arthritis, among others. For this reason, it is important to explore and understand the metabolic pathways in which SAA is involved. This goal can be achieved by studying SAA interactions with proteins expressed in activated THP-1 macrophages by using the co-immunoprecipitation assay. The isolation and subsequent characterization of those unknown proteins bound to SAA will be achieved by Western blot and mass spectrometry, respectively. First, we are in the stage of searching the optimal conditions for the expression of the SAA in THP-1 cells after induction with dexamethasone and lipopolysaccharides. Second, we are validating our Western blot protocol for good antibody recognition to the target protein prior to perform the third step which is the co-immunoprecipitation assay for the isolation of SAA complexes. We want to acknowledge the collaboration of Dr. Wilfredo Colón and his graduate students of Rensselaer Polytechnic Institute at NY, the BioMinds Program, sponsored by Amgen, PR and the Puerto Rico Louis Stokes Alliance for Minority Participation for the funding support given through the academic year 2009-2010, the Chemistry Department and the laboratory peers.

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STUDY OF THE SULFHEMOGLOBIN’S ORIGINAL DNA STRAND

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The sulfhemoglobin is very unique hemoglobin which can be found within the species Leucina pectinata, an oyster that lives in a H2S sulfur rich environment. What is peculiar about the hemoglobin is the fact that its functionality has been altered from a natural transportation of oxygen to the transportation of H2S. This is interesting to us because of the fact that in a normal human being, high concentrations of H2S can be fatal. But if we were to be able to control the levels of H2S in a human body, we can cause an artificially induced hibernation. This has real world applications because it means that we would be able to send astronauts to the moon and have them waste very little amount of their food stock and water. This is due to the fact that during hibernation, one’s body shuts down to minimal levels of functionality, allowing for the human body to go long periods of time with very few nutrients. Another justification for the study would be that there are worms found in thermal vents with high concentrations of H2S that tend to live an extremely long lifespan compared to other worms of its type. We believe that H2S has a major role to play in its enhanced life span and that is why we can say that another real world application of this research would be life expansion. Our goal in our part of the research program is simple: complete the original strand of DNA that codes for the sulfhemoglobin. What we are doing is going through the central dogma of genetics in reverse. So far we have the protein, but we need the original strand. The experimental methods used in our research are plasmid verification, electrophoresis, PCR and centrifugation. Everything needed in order to do DNA coding. The progress we’ve made so far is coding for about 3/4ths of the original stand, we are still missing an intron, exon, and the promoter region. This is essentially the hardest part of the original DNA strand to find because of the fact that the promoter region is just the part of the DNA that is used to prepare for the genetic code. Which means it isn’t part of the original strand, but we still need it because it is an initiator in the procedure, it is very difficult to find. Hopefully by the end of the semester we will have finished the complete original DNA strand, but that is only an idealized statement. I plan on continuing my investigations with prof. Juan Lopez Garriga and Ingrid Montes if they will have me. Hopefully then we will truly be able to complete the original DNA strand.
SYNTHESIS AND SPECTROSCOPIC STUDIES OF UREAS AND THIOUREAS DERIVED FROM 2-METHYLINDOLINE
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Previously, the urea prepared from the reaction of indoline with phenylisocyanate in benzene at room temperature; and the thiourea prepared by the reaction of indoline with potassium thiocyanate in acid medium were studied by Nuclear Magnetic Resonance Spectroscopy. The $^1$H-NMR spectra of these compounds revealed that in solution, these compounds also exist as a mixture of rotamers. The studies have been extended to urea IIA and the thiourea VA, to determine if these also exist as mixtures or rotamers, and to determine the effect of the methyl groups on the per cent of each rotamer in solution.

PREPARATION OF 2-ALLYLCYCLOHEXANONE BY THE ACETOACETIC ESTER SYNTHESIS USING PHASE-TRANSFER CATALYSIS
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The compound 2-allyl cyclohexanone (1) has proved to be useful in the synthesis of perhydroindole derivatives. Among the methods for the synthesis of this compound are: treatment of cyclohexanone with a strong base, and then adding an allyl halide; and the alkylation of the enamine of 1 with an allyl halide. However, the yields are not very high or the method generates a considerable amount of chemical wastes. In this research, the preparation of 1 using the acetoacetic ester synthesis has been studied. The compound 2-carbethoxycyclohexanone (commercially available) was used as the substrate along with allyl bromide as the alkylating agent using phase-transfer catalysis conditions.
The research presented herein provides a feasible way in which to create protocols for efficient standards for trace explosive detection. It pursues studies on surface contamination properties, trace sample preparation methodologies, detection systems response, and generation of explosive contamination standards for trace detection systems. Homogeneous and reproducible sample preparation is relevant for trace detection of chemical threats: warfare agents, explosives and toxic industrial chemicals. The research activities include (1) study the properties of particles generated by several deposition techniques such as smearing deposition and inkjet deposition on different substrates; (2) characterization of the composition, distribution, size and adhesion of deposits; (3) evaluation of the accuracy and reproducibility depositing pure explosives and mixtures such as TNT, RDX, and ammonium nitrate; (4) study of the response of systems using Micro-RAIRS and (5) generation of the protocols for validation of surface concentration using nondestructive and destructive methods. Recent progress has been made in the preparation of explosives standards on nontraditional surfaces such glass and gold plated silicon. Residence time of the explosives on the surfaces depends on the physical characteristics of the sample. Use of stabilizing agents is being explored to help some samples remain longer on surfaces. Other explosives such urea nitrate, TATP, and PETN will be used for standards preparation. The TIJ method has been determined to be a better method of depositing sample than smearing and white light images have shown that the deposited explosives are in a metastable form, unless high concentration induces crystallization. It has also been found that sublimation time depends on the physical behavior of the explosive in use, as determined via Fourier Transform Infrared (FTIR) analysis. Lastly, the protocols must be catered to the unique behavior of each explosive, as each requires individual solvent preparation. Efforts will be directed to develop knowledge in the area of explosives-surface interactions. Results can lead the way to the development of standards that can be used for evaluating performance of trace analysis detection systems protocol effectiveness.

Semiconductor oxide nanorods exhibit chemical properties and thermodynamic stability associated to their size, which improves the present problem of steric stabilization that silver and gold colloids have. Shape-controlled synthesis of zinc oxide film is very important since almost all properties of its thin films are dependent of shape and size. Magnetron sputtering is a convenient technique to make particle size in a uniform manner by sowing seed. In contrast to other methods which result in high polydispersity and a variety of shapes, this method offers narrow size distribution and near spherical particles. The goal of this study was to prepare neat and gold nanocovered ZnO nanorods. A second but important goal was to test the substrates as suitable for SERS detection of 4-nitrobenzenethiol. Two samples of Au-coated on rod and Nanorod on growth were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS). The diameter of the nanorods was controllable during the synthesis by wet chemistry different average diameters of 250 and 131 nm were prepared to investigate the size dependence of the surface enhanced Raman scattering (SERS).
P46
CYCLIC VOLTAMMETRY: ANALYSIS OF THE REDOX REACTION OF COPPER WITH HYDROGEN PEROXIDE IN GLASSY CARBON ELECTRODE
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Copper is an important trace element worldwide that can exist in two oxidation states. Elevated concentrations of this ion can be lethal for organisms because can alter the metabolism. In ground waters, naturally, the ion copper exists in the oxidation state (II), but recent researches have determined the presence of this cation in the oxidation state (I) due to the presence of hydrogen peroxide. In this work the principal objective is the determination of the rate constant of oxidation of Copper present in a solution of Copper Sulfate and KCl with Hydrogen Peroxide in 2:1 quantities. The reactions were scanned and monitored by implementing Cyclic Voltammetry method using a model CV-50W Voltammetric Analyzer at a scan rate of 500μV/s on a Glassy Carbon surface electrode. The sweeping was performed from +1V to -1V and later were screened down to +400μV to -400μV applying a sensitivity of 10 μA/s and then segments for both cases. All the scans were made at room temperature (25°C).

The presence of hydrogen peroxide is found to accelerate the rate constant (k) of the reduction of Cu(II) to Cu(I) by approximately 1.1E-08 M, lowers the current of the cathodic peak and inhibits the oxidation of Cu(I) to Cu(II).

In next experiments we will determine the rate constants using faster voltage scan rates to detect the conversion of Cu(I) to metallic Copper. Also test the reaction on another electrode surfaces.

P47
STUDY OF SULFHEMOGLOBIN FORMATION IN LUCINA PECTINATA
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The sulfhemoglobin is a derviative of the non functional hemoglobin that is formed by the ingestion of drugs with sulfate compounds, exposition to environmental pollution and to compounds related with the sulfur. This complex is formed from the reaction of the heme group of the hemoglobin with hydrogen sulfide in presence of hydrogen peroxide. This reaction produces hemoglobin with sulfur an adhered to the pyrrole B of the heme group. The sulfhemoglobin has a characteristic absorbance in 620nm. It is a complex of great importance in the clinic world because this is the cause of an anemia known as sulfhemoglobinemia. The sulfhemoglobin complex is formed in human as in to animals. However, the clams as the Lucina Pectinata do not form this complex. This has three types of hemoglobin HbI, HbII and HbIII, but neither of those forms that complex. Studies say that when aminoacid of the heme group of the human as Histidine in glutamine, aminoacid of the clam is added, in the position E7, the sulfhemoglobin is formed without difficulty. This shows that the aminoacid responsible for the complex formation is Histidine in E7. According to those studies, our research is dedicated to find the mechanism of the reaction and which were the more favorable conditions for a better formation and stability of the sulfheme complex. This way should collaborate with the medicine to create others less dangerous treatments and healthier to fight the sulfhemoglobinemia.
EMPLOYING LASER TREATMENT TO STUDY STRUCTURAL EFFECTS OF BIMETALLIC PARTICLES AND POTENTIAL APPLICATIONS IN SERS DETECTION OF HIGH EXPLOSIVES

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This work focuses on the synthesis of gold covered copper nanoparticles and gold core-silver shell nanoparticles. The effect of the nanoparticle structure was studied after pulsed and continuous laser treatments with UV-VIS spectrophotometry. Two different experiments involving the effect of the laser treatment on the nanoparticles were carried out. One included preparing the nanoparticles suspended in a colloidal solution and later irradiating these solutions colloid with the laser. The other method involved the preparation of the nanoparticles with direct irradiation of the continuous and pulsed laser. We report on the use of copper-gold bimetallic nanoparticles to obtain the Raman spectra of crystal violet and other SERS active analytes on the surface of these nanoparticles. Raman activity of crystal violet ion using as excitation sources 514.5 and 532 nm lasers was measured. Surface enhancement factors (SEF) were measured at both excitation sources. At 514.5 nm, the signal enhancement of crystal violet (5.0 x 10⁻⁶ M) was much larger than at 532 nm. Results suggest that the orientation of crystal violet ion is perpendicular to the surface of the bimetallic structure. The particles synthesis presented in this work could be useful in the investigation of various optical phenomena, as novel supported photocatalyst, or as candidates for photonic crystals. The bimetallic particles may present superior optical, electronic and magnetic properties than their monometallic counterparts. The tuning of these materials absorption peaks could offer the prospect of the assembly of a novel functional device, as well as new catalytic materials as well to develop sensor devices.

ENVIRONMENTAL REMEDIATION OF EMERGING MICROPOLLUTANTS BY PHOTODEGRADATION

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Pharmaceuticals and personal care products (PPCPs) are substances of widespread use for human and veterinary applications. The widespread use of these chemicals by general public has made them an emerging pollutant of concern. Especially when trace amounts of PPCPs in wastewaters can lead to chronic health exposure and the occurrence of drug resistant pathogens. Current water treatment facilities are not designed to remediate PPCPs present in water effluents augmenting their potential environmental risks. The work proposed herein uses polymer micro-composites as substrates to catalyze the UV photodegradation of PPCPs. The effectiveness of the remediation process was monitored by HPLC with UV detection. The benefits of using composite materials for the remediation of PPCs are discussed. The potential of using natural and recycle materials as eco-friendly sorbents and catalysts is presented.
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EGG-WHITE LYSOZYME CRYSTALLIZATION BY EQUILIBRIUM TECHNIQUES
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Macromolecular crystallography is the study of macromolecules (proteins and nucleic acids) using X-ray crystallographic techniques for determining their molecular structure, but one of the main requirements for these initiatives is a high-throughput crystallization facility to speed-up the protein identification process. Thus, for wanting to determine the structure of a protein, the crystallization process is indeed very important. This experiment looked forward to finding the optimal conditions to make a single large (scale of millimeters) lysozyme crystal. As for a model in this research Egg-white lysozyme was used because it is a widely understood and researched protein which makes it a perfect model used to practice crystallization methods. Hanging Drop Vapor Diffusion and Batch were used as main screening techniques. The screening conditions used for lysozyme crystal grow were a gradient of NaCl, ranging from 5% to 30% w/v [5%, 7%, 10%, 15%, 25%, 30%] versus a gradient of protein concentration ranging from 25 to 80 mg/ml [25, 40, 60, 80] (for Hanging Drop) and three rates of NaCl|protein of 5.5%|50 mg/ml; 5.0%|55 mg/ml; 6.0%|60 mg/ml (for Batch), plus a NaClH2O 0.1M buffer to keep pH 4.8-5 to an optimum. Crystal grow was monitored for three weeks. The conditions of 5% and 7% w/v NaCl for 60mg/ml of Lysozyme proved to be the best ones. Varying the NaCl saturation can alter nucleation process. It was observed that higher salt concentrations induce faster nucleation rates. Future works will focus on finding the optimal crystallization methods for Lucina pectinata’s Hb II. Acknowledgements to Lopez Garriga’s Lab Group, The BioMinds Program, The UPRM and Sigma Xi for the opportunity.

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IMPROVING HYDROLOGIC PREDICTIONS IN UPLAND TROPICAL AREAS
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To improve hydrologic predictability in mountainous areas and tropical environments, a subwatershed laboratory was delineated within a 3.55 km² area, where 28 rainfall stations and one stream stage data logger were installed. The Test Bed Subwatershed (TBSW) is characterized by high rainfall variation over very short distances, less than 200 meters, due to topography, convection and the local sea breeze effects. New radar technologies are being developed with super high spatial resolution (10 meters) by the Collaborative Adaptive Sensing of the Atmosphere (CASA) project at UPRM. It is crucial to define the optimal rainfall input resolution for hydrologic models, in terms of model performance, which is crucial in a Flood Alarm System. A distributed hydrologic model had been used because it’s capacity to detect small spatial variations and predict flow and stage cell by cell. A rainfall analysis was conducted for 2007 comparing radar estimates (Multisensor Precipitation Estimation Algorithm) at a 4km resolution with our high resolution rainfall network (approximate 200 m resolution). High bias variations were observed over the year, especially at the hourly time step and the average false alarm rate was 0.45. The methodology used in this study to quantify the hydrologic predictability due to input resolutions was an up-scaling experiment that consisted in evaluating different grid size inputs and parameter maps in a distributed the hydrologic model. The quantification will be addressed using an ensemble approach and GLUE methodology, which will provide knowledge about probability distribution functions associated with each scale.
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ENHANCEMENT OF REACTIVE OXYGEN SPECIES PRODUCTION IN NANO PARTICULATE
BIMETALLIC ZERO-VALENT IRON AND DIOXYGEN SYSTEM
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Recently, an innovative oxidative process based on nanoscale zero valent iron in presence of oxygen (nZVI/O₂) has been demonstrated to oxidize a variety of aqueous organic pollutants. Decomposition of these organic molecules is due to production of reactive oxygen species (ROS) such as hydroxyl radicals. This study is to maximize the ROS production using bimetallic nZVI particles. The central hypothesis is that more ROS can be produced due to formation of galvanic cells between Fe⁰ and the secondary metal additive within the nanoparticles. The two essential intermediate products, hydrogen peroxide and ferrous ions, were measured under different species and contents of secondary metals. And then ROS was quantified by indirect probe compound tests. Bare and bimetallic zero-valent iron nanoparticles were synthesized by aqueous-phase reduction of ferric chloride through the dropwise addition of sodium borohydride solution. All reactions were completed in sealed 73 mL serum vials filled with O₂-saturated pH buffered solutions. Ferrous ions were measured by monitoring absorbance of Fe(II)-bipyridine complex at 522 nm. Hydrogen peroxide was tested using DPD method. The results showed that the lower levels of Fe²⁺ and H₂O₂ were detected for bimetallic nZVI than ZVI due to the coverage of the second metal on the nZVI surface. These observations provide a deep insight into the underlying mechanisms of ROS production. This research is supported by the Institute for Functional Nanomaterials (IFN) through NSF EPSCoR program.

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INVESTIGACIÓN DE CAUSAS DE EXPLOSIONES EN PLANTAS PETROLÍFERAS:
EL ACCIDENTE DE BUNCEFIELD
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Se estudia el accidente ocurrido en un gran depósito de combustible en el Reino Unido, al norte de Londres, a finales del 2005, con el fin de identificar el proceso de formulación de hipótesis que se llevaron a cabo para explicarlo. La importancia de este accidente está asociada a la gran magnitud del daño ocasionado, que excedió en mucho el valor de las estructuras destruidas. Por otra parte, el incendio producido fue de tal magnitud que destruyó la mayor parte de las evidencias que habrían permitido identificar fácilmente las causas. El trabajo describe el depósito de Buncefield y sus tres niveles de contención; a continuación se describe el incidente ocurrido en 2005 y la evolución de las hipótesis formuladas para identificación de las causas. Finalmente, se describen las consecuencias ambientales y legales del incidente, y las lecciones aprendidas del estudio.

El caso de Buncefield resulta interesante debido a que la destrucción masiva asociada al fuego y a las explosiones impidió localizar fácilmente el origen del incidente. Tal identificación fue posible gracias a testigos circunstanciales que reportaron sus observaciones, y al monitoreo del circuito cerrado propio de la planta. Otros elementos fueron las fotografías aéreas tomadas en las primeras horas. La evidencia necesaria para postular una hipótesis de falla en un componente determinado que pudiese explicar la causa del evento fue suministrada por los registros de monitoreo de las operaciones de movimiento de combustible. Éstos permitieron vislumbrar la secuencia de eventos que podrían haber ocurrido para que se escapase combustible del circuito primario de contención. Finalmente, quedaba por descifrar de qué manera se esparció el combustible, volatilizándose en parte. Ante la carencia de evidencias, se llevaron a cabo ensayos en un modelo del tanque especialmente construido para verificar la hipótesis.

P54
ALGINIC ACID-AIDED ALCOHOL FLUSHING FOR TCE REMOVAL FROM TIGHT ZONES
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In situ flushing for dense non-aqueous phase liquids (DNAPLs) remediation is done by the injection of an aqueous solution into the zone contaminated with them, followed by down gradient extraction of groundwater, elutriate and aboveground treatment. Trichloroethylene (TCE) was used to represent the DNAPL. Permeability is the principal cause which the flushing solution moves through a porous medium and, therefore, determines how effective the remediation of the zone contaminated is. The objective of the research is to evaluate behavior of in situ alcohol flushing in aids of natural polymer, alginic acid, to enhance overall remediation effectiveness of TCE in the heterogeneous subsurface setting with different permeability. The parameters measured were the flushing solution pressure, transport extent and concentration of the TCE. The results showed that alginic acid-aided alcohol flushing was able to modify permeability contrast and enhance TCE removal from the lower permeability zones.

P55
POINT-OF-ENTRY (POE) CISTERN WATER PURIFICATION UNITS (CPU) DEVELOPMENT
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The research aims to develop a POE-CPU to be implemented in the US Virgin Islands (USVI) to guarantee water quality. Rainfall is very seasonal, and desalination supplies about 80% of the water used. More than 50% of the residences use rainwater cistern, and water is often transported to refill the reservoirs. A great potential for water supply to get exposed to secondary contamination from pipes, pumps and transportation is present. Also contamination can be contracted at the collection point, due to pollution, bird and reptile waste and deposition of particulate matter. Another factor in the contamination is the aged structures and poor maintenance, all of which result in infectious diseases and other pathogenic illnesses. A lab-scaled POE-CPU gravel and sand filtration and disinfection unit was tested. Rainfall was collected periodically, pumped through the system and disinfected with sodium hypochlorite, and samples were gathered at each sample port. Analysis was conducted for physiochemical and biological characteristics of water. The physiochemical parameters tested resulted in compliance to Water Drinking Standards. Sand filtration reduced the concentrations TC and THB. Future study includes additional run focusing on bacterial water quality and reduction of disinfection byproducts, while ensuring water quality. It is important to choose water sanitation technologies that are affordable and can be easily operated and maintained by local service providers or by community people.

P56
BIOMETHANATION OF CHICKEN MANURE
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The QMS research fellowship was awarded for a study on the development of an alternative resource recovery by generating methane (CH4) from a poultry farm byproduct, chicken manure (CM). First, biomethanation of CM in a dry mesophilic anaerobic digestion (DMAD) has been conducted. A dry thermophilic anaerobic digestion will be followed. Biogases were gradually produced and reached to 145 mL/mg VS after one month of DMAD. Methane concentrations were periodically quantified and volumetric percentage of CH4 in the biogas produced was increased and reached to ~30% of the biogas after one month of the DMAD.
RESISTANCE TO PAPAYA RINGSPOT VIRUS IN F3 FAMILIES OF TROPICAL PUMPKIN (CUCURBITA MOSCHATA)

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Papaya ringspot virus (PRSV) is one of the two most common viruses affecting tropical pumpkin (calabaza) in Puerto Rico. One of the goals of our breeding program at the University of Puerto Rico is to incorporate resistance to PRSV into local cultivars of tropical pumpkin. C. moschata cv. Nigerian Local (NL) has been used as a source of resistance to various cucurbit viruses, including PRSV. Inheritance of PRSV resistance was previously reported to be a single recessive gene. However, our experience when attempting to backcross NL resistance into tropical genotypes of C. moschata suggests that the inheritance might be more complex. In this research we evaluated F3 families derived from self pollination of PRSV resistant F2 plants. Plants within F3 families would be expected to be all resistant (not segregating) if resistance is controlled by a single recessive gene. A total of 18 seedlings from each of 10 F3 families were mechanically inoculated at 7 days after planting with PRSV. At 20 days post-inoculation ELISA (enzyme-linked immunosorbent assay) tests were carried out on each seedling. Plants were also scored for severity of disease symptoms. No family was completely free of symptoms. However, in almost all families the average ELISA reading was lower than the mean of the susceptible controls. The most resistant plants (based on ELISA readings and severity of symptoms) were transplanted to the field. Most plants continued to show mild symptoms in the field. However, some families had plants that showed very few symptoms. Our results indicate that inheritance of resistance to PRSV in tropical pumpkin is controlled by more than a single gene.

FRUIT AGE AFFECTS GERMINATION OF SEED OF CAPSICUM CHINENSE

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This study was designed to determine the effect of fruit age on seed germination in sweet chili pepper (ají dulce) (Capsicum chinense Jacq.). Four plants of each of four genotypes were planted in cement boxes. Flowers were tagged at anthesis and the date was noted. Fruit was harvested at 5-day intervals starting at 20 days post-anthesis (20, 25, 30, 35, 40, 45 and 50 days post-anthesis). For each combination of genotype and fruit age, 40 seeds were planted in the greenhouse in plastic trays filled with commercial planting mix. The number of plants germinated was counted each day from 4 to 14 days post planting. Seed germination occurred in 30 to 50 day old fruit with optimum germination and vigor in seeds from 35-45 day old fruit. There was some reduction in germination and vigor in the 50 day old fruit compared to 35 to 45 day old fruit. Fruit color changed from green to red at about 30 to 35 days post-anthesis. Thus fruit color is a good indicator that a fruit contains viable seed capable of germination.
CROSS-POLLINATION IN “AJÍ DULCE” (*CAPSICUM CHINENSE*) IN PUERTO RICO

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*Ají dulce* (*Capsicum chinense* Jacq.) is an important crop in Puerto Rico used in the preparation of *sofrito*. The Puerto Rico Agricultural Experiment Station carries out research on the development of new cultivars of *ají dulce*. Within this program it is important to understand how genetic materials should be managed. *C. chinense* has perfect flowers and is capable of carrying out self-pollination. Theoretically all the progeny of a plant of *C. chinense* contain the same characteristics as the parent plant. However, this is rare because, among other reasons, cross-pollination can occasionally occur. In plants of the genus *Capsicum*, the percentages reported of natural cross-pollination range from 0 - 91%. This research has the goal of determining if natural cross-pollination of *C. chinense* occurs in Puerto Rico. Twenty seven plants of each of three different genotypes of *C. chinense* (designated 6, 7 and 10) were planted in Lajas, Puerto Rico. For each genotype, seeds were extracted and bulked. From each bulk a sample of seeds was planted. These progeny plants were evaluated phenotypically and genotypically. The fruit of the three different genotype progenies were characterized according to their shape and color. DNA from the mother plants and from a representative sample of the progeny of each genotype was extracted and then amplified by PCR, using RAPD markers (Randomly Amplified Polymorphic DNA markers). We performed Agarose Gel Electrophoresis to compare the genetic fingerprints of the mother plants with the genetic fingerprints of the progeny. Based on the similarity or difference of the genetic fingerprints, as well as phenotypic evidence, we concluded that natural cross-pollination occurs in *C. chinense* in Puerto Rico.

NUTRIENT DISTRIBUTION IN SOILS FROM THE COLOSO VALLEY AGRICULTURAL RESERVE AT PUERTO RICO

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From to 3-5 million acres of prime agricultural land in the US are lost each year due to inadequate soil management, and chemical over-fertilization and pesticide pollution. This is a major concern in areas with limited food resources such as Puerto Rico who requires at least 650,000 acres of land to supply the nutritional needs of its inhabitants. Given the shortage of cultivable soil that actually exists and the lack of adequate land management and development is vital to sustainable development of the region. This study, focuses on the quantitative analysis of Copper (Cu), Magnesium (Mg), Manganese (Mn), and Potassium (K) in Coloso and Voladora clay at trace levels. The analysis was performed using standard additions atomic absorption spectroscopy. An analysis of the nutritional requirements of each sampled soil is presented. The types of crops that are more adequate for the sustainable harvesting of these soils are discussed.
P61
PETROGRAPHIC ANALYSIS OF THREE INTRUSIVE MAFIC COMPLEXES IN VIRGIN GORDA, BRITISH VIRGIN ISLANDS
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Three mafic intrusive complexes exposed in southern Virgin Gorda, British Virgin Islands were petrographically examined. Each complex displays igneous textures characteristic of crystallization processes in mafic magmas, including igneous layering, orbicular features and cumulate texture. What is most curious about these textures is the proximity of their exposures to each other, at approximately 1 to 3 km, and their occurrence at the margins of the Virgin Islands granodiorite batholith. Current geologic mapping of the Virgin Islands describes a vertical sequence of keratophyre and spilite flows, pyroclastics, limestone and the granodiorite batholith, amongst other units. No previous descriptive studies of the Virgin Islands have discussed the textures studied and current geologic maps briefly describe them as igneous and metamorphic. The data obtained will then lead to a more precise and contemporary mapping of the Virgin Islands geologic units. Petrographic analysis has identified the following mineral assemblages in thin section: clinopyroxene (cpx), amphibole and plagioclase (plag), with minor presence of oxides, for the layered rock; cpx, orthopyroxene (opx), olivine, alkaline feldspar (k-spar) and biotite, for the orbicular rocks; and k-spar, plag, quartz and cpx for the cumulate rock. Ongoing studies include X-Ray Fluorescence (XRF) and Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS) analysis for determination of minor, major and trace element abundances. The results obtained will test the hypothesis that (1) a layered mafic intrusion exists in the Virgin islands and (2) the three complexes are related.

P62
ANALYSIS OF SHOCKED MINERALS FROM THE VAAL RIVER TERRACE DEPOSITS, SOUTH AFRICA
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The oldest known impact structure on Earth is the Vredefort Dome in South Africa, approximately 2.02 billion (Ga) years old. Its original diameter is estimated to be ~250-300 km (Reimold & Gibson, 2005). Approximately 8-10 km of the upper level of the impact structure and ejecta have been removed by erosion in the last 2 billion years. The Vaal River flows across the northern area of the Vredefort impact structure in an east-to-west direction; its erosional effects played an important role during the Cenozoic. Cretaceous to Holocene age paleochannel deposits (river terraces) provide a record of sediment transported by the Vaal during these times. Preliminary evidence of shocked minerals eroded from the Vredefort Dome has been found in the Pleistocene age Vaal River terrace deposits (Cintron, 2009). This study is focused on the analysis of shocked zircons preserved in silicilastic sediments from the Pleistocene age (1.5 million years old) Rietputs Formation along the Vaal River, South Africa.

Shocked minerals serve as excellent indicators of impact events since they display a unique set of features that form along the grain caused by the release of elastic energy from mineral lattices upon the passage of a shock wave (Reimold et al., 2002). The textures form over a wide range of pressures; textural changes are proportional to increasing shock pressures (Bohor et al., 1993). The planar fractures are of great importance since these are resistant to post-impact annealing (Kamo et al., 1996). Cavosie et al. (in press) demonstrated that shocked minerals can be preserved and identified in sediments up to 2 Ga after an impact event. We focus on the mineral zircon (ZrSiO4) since it is widespread and is the most durable in impact environments. Shocked zircons preserve planar fractures (PFs), caused by the impact event.

Six terrace samples were collected near Windsorton South Africa, ~500 km downriver from the Vredefort Dome. Analysis of shocked zircons is being performed with a scanning electron microscope (SEM), located in the physics department of the University of Puerto Rico, Mayaguez. The samples were washed and sieved to 500 microns. Magnetic separation was performed on each sample using a Frantz Isodynamic Separator, located at the University of Wisconsin. Zircons are imaged using an optical light microscope and then with the SEM on carbon-taped stubs to image the external grain surfaces. To date, 8 shocked zircons have been identified in two of the terrace samples. Special thanks to Timmons Eriksson for assisting in sample processing.
Our continuous GPS monitoring at the Cerca del Cielo, Ponce, Puerto Rico landslide clearly indicated that rainfall had exerted a dominant control on the movement. A large and rapid movement would be expected during future storm seasons. The sliding mass completely cut through the sole access road to the community. However, there are still about 50 families living in this community. People driving daily through the sliding mass are at significant risk. It is even possible that the sliding mass would completely slide down the area during a heavy rainfall. This will completely cut down the transportation, water, and power supplies to the neighborhood inside the community. Real-time GPS monitoring can detect early indications of rapid and/or catastrophic movement. We equipped a real-time GPS facility at the landslide to monitoring the movement since the beginning of February 2010. A weather station was also installed at the GPS site to record rainfall data. The real-time calculation is conducted by the GREAT (GPS Real Time Earthquake and Tsunami) Alert Project and the Global Differential GPS (GDGPS) System at JPL.

No evidence of meteorite impacts has been recognized from the early Earth and Hadean eon. A new approach to discover the early impact history of the Earth is through identification of detrital shocked minerals. During a meteorite impact, the forces exerted on the target rock form unique microstructures within their minerals, known as shock textures.

The 2.02 Ga Vredefort Dome is the largest and oldest identified impact structure on Earth. The Vredefort structure is 90 km wide and is the eroded remnants of the central uplift of a 300 km wide multi-ring impact basin. The Vaal River crosscuts the Vredefort Dome and flows 750 km further west to its confluence with the Orange River. The town of Parys demarks the approximate center of the Vredefort Dome on the Vaal River. Cavosie et al. (in press) identified detrital shocked zircons from sediments in the channel of the Vaal River and its tributaries within the Vredefort Dome. We have extended the occurrence of shocked zircons within the channel sediments of the Vaal River ~750km downstream from the Vredefort Dome to confluence of the Orange River. Zircons were analyzed by scanning electron microscopy (SEM). Shocked zircons were identified in 7 samples, including the furthest downriver sample near Douglas, approximately 750 km from Parys. Planar fractures (PFs) were recognized in euhedral, subhedral and rounded zircons that show varying degrees of sedimentary abrasion.

A shocked zircon identified from the furthest down river sample is subhedral and expresses multiple sets of PFs. Grains exhibit up to 5 distinct sets of planar fractures, with 95% of the identified shocked zircons exhibiting at least two sets of PFs and >50% displaying 3 sets. This study demonstrates that shocked zircons survive sedimentary transport to distal locations (~750 km of fluvial transport) and are therefore a robust record of eroded impact structures. Shocked zircons will likely remain within detrital systems long after erosion and tectonics have destroyed the original impact structure. An impact record from the early Earth may therefore exist as shocked zircons in Archean siliciclastic deposits containing Hadean detritus.
P65
PETROLOGIC AND GEOCHEMICAL STUDY OF CULEBRA’S EASTERN CAYS: CAYO NORTE AND CULEBRITA, PUERTO RICO
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Quantitative studies of aphanitic and porphyritic lavas form Cayo Norte and Culebrita are the main goal of this investigation. Until the present day qualitative studies have been done on of lavas of Culebra’s cays. Igneous rock compositions were classified as andesitic more than forty-five years ago. In order to build on previous works done on the cays petrographic studies are proceeding and will be complemented with geochemical analyses such as X-Ray Fluorescence (XRF) and Inductively Coupled Plasma Mass Spectroscopy (ICP-MS). XRF studies will give the percentages of minor, major and trace elements. Results will be analyzed for comparison purposes in order to obtain environmental settings of where these lavas occur including island arc and mid ocean ridges as possibilities.

Pillow lavas and lava flows in thin sections reveal zonations and significant weathering of phenocrysts of plagioclase and clinopyroxene (cpx) of the aphanitic lavas. Such weathering features are similar to those of magmatic disequilibrium which are also in existence. Disequilibrium textures are the direct evidence for these conclusions. Secondary minerals such as quartz, epidote and chlorite indicate the lavas interaction with the environment after genesis and alteration of the primary minerals. These are present in both Cayo Norte and Culebrita lavas.

The confirmation of submarine environment for the pillow lavas and the subaerial lava flows in addition to the compositional evidence form the geochemical data will manifest the environmental settings for the genesis of the extrusive igneous rocks of Culebra’s cays. Furthermore it will aid in the clarification of depositional sequences of the lava flows and pillows.

P66
DETECTION OF SALMONELLA IN MUNICIPAL SLUDGE COMPOST
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The Municipal Sludge Compost is used as amendment in agricultural soils and as an alternate crop for peat moss providing excellent results in the crops. However agricultural use may be affected by the presence of pathogenic microorganisms. Some of the concerning bacteria are Salmonella which possess the capacity of transporting themselves through the interior of the plant. For this reason the need arises to carry out this research where the objective was to determine the presence of the bacteria Salmonella spp. in the BMC. Samples were analyzed from four compost plants in Arecibo and Mayaguez. The compost differs in periods of storage and composition. For the analysis of samples, dilutions are made from $10^{-1}$ to $10^{-6}$ using 25 g of each compost. The 10 ml of each dilution were added to the nutrient media provided by the protocol 3M™ TECRA™ UNIQUE Salmonella for the detection of Salmonella spp. The samples were incubated at the intervals recommended by the manufacturer. A reagent containing the culture medium indicated the results. As a control, a pure culture of Salmonella was analyzed. The results of the samples showed total absence of Salmonella. According to these results it is possible to recommend this product in the cultivation of ornamental plants. We should consider that the compost used has complied with the adequate composting process. More research is recommended with compost at different intervals using other healing methods.
P67
COMPARISON AND VALIDATION OF CHEMICAL AND BIOLOGICAL ANALYTICAL TECHNIQUES TO
MONITOR BATCH CULTURES OF CHINESE HAMSTER OVARY CELLS IN A BIOREACTOR
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Chinese Hamster Ovary cells (CHO cells) are the preferred mammalian cells used for the production of human recombinant monoclonal antibodies in the biotechnology industries. These cultures are performed in large scale bioreactors using batch or fed-batch modes of operation. Finding appropriate technologies in order to establish a trustable and continuous monitoring system is crucial in order to obtain a desirable product from biological agents like mammalian cells. In the case of mammalian cell bioreactors, several process variables are of chemical nature, while others have a biological origin. Diverse instrumentation may be helpful to measure offline these two types of variables.

In the case of a biological measurement, such as CHO cell count and viability within the bioreactor, the “classical” approach is to use Trypan Blue staining of the cells with viable and dead cell count using a hemocytometer. A more automated measurement can be rapidly obtained using equipment such as the Cellometer Auto T4, which can provide the same data in a few minutes. The automated results from the Cellometer Auto T4 equipment are obtained in a short period of time, but the optical device of the system sometimes fails to visualize certain features of the samples. Using the hemocytometer requires a longer period of time due to its manual nature, as well as it is subject to a high error and variability constraints because of human intervention in the analysis.

In the case of a chemical measurement, such as glucose and lactate concentrations within the culture media, the “classical” approach is to collect samples from the bioreactor and analyze these compounds using High Performance Liquid Chromatography (HPLC). These concentrations can also be measured using a YSI Biochemical Analyzer, which uses immobilized enzyme technology to quantify the analytes in a faster, more automated way. Similar to the biological techniques described above, both methods have their pros and cons. The HPLC delivers accurate analyses of the compound’s concentrations, but requires a longer processing time to obtain results. The Biochemical Analyzer provides faster results but it is less accurate.

This work will report how the “classical” analytical technologies will be compared to the “automated” analytical technologies for both the biological and chemical types of variables for a mammalian cell culture bioreactor. Several samples containing varying concentrations of glucose, lactate, and cell counts will be simultaneously analyzed using the “classical” It will be shown how to determine he sand “automated” approaches and data will be statistically analyzed to validate one method against the other, as well as repeatability and reproducibility will be assessed for both approaches. These results will be further used in the future to implement inline sampling techniques, such as Raman spectroscopy, to improve the monitoring and automated control of mammalian cell bioreactors to improve productivity and quality of products.

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P68
STUDY OF THE SULFHEMOGLOBIN’S STABILITY
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The Sulfhemoglobin is a greenish substance derived from hemoglobin. This not- so-known substance can cause a rare condition, usually called sulfhemoglobinemia. This rare condition is produced when there is an excess of Sulfhemoglobin in the blood. When a sulfur atom is incorporated into the hemoglobin molecule, the hydrogen sulfide and the ferric ions combine in the blood, causing the incapability of the blood to carry oxygen. The necessary reagents for the Sulfhemoglobin formation are known, but the complex stabilization is difficult. Once the stability of the derivates is obtain, the known crystallization techniques can be incorporated. Different factors have been modified throughout the years, such as the necessary buffer to carry out the reactions or the relation between the reagents used to produce Sulfhemoglobin. Learning the manipulation and formation of the sulfmyoglobin specie was
carried out using peroxide, catalase (to remove \( \text{H}_2\text{O}_2 \) excess) and, sodium sulfide, as a precursor of \( \text{H}_2\text{S} \), in an EDTA, Succinic acid, and potassium phosphate buffer. The starting protein had a 3.21 mM concentration and a 1:4:1.5 (\( \text{Mb: H}_2\text{O} : \text{H}_2\text{S} \)) relation. A high yield of sulfheme was obtained, which is favorable for the crystallization stage. A trial of the hanging drop technique, which will be use for crystal growth, was conducted. The goal is to reproduce previous stabilization experiment using potassium cyanide and develop a stabilization process for the sulfheme without the further manipulation of the specie.

**P69**

SCREENING FOR UREASE ACTIVITY IN METAGENOMIC LIBRARIES FROM TROPICAL AND DRY FOREST IN PUERTO RICO

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Emerging disciplines and technologies, especially involving molecular biology, have allowed the study of microbes that are not able to grow using conventional culture media. The use of metagenomic libraries has allowed unraveling the presence of novel microbial groups and new enzymatic activities with application in biomedical sciences and biotechnology by using culture independent approaches. Urea is a product when proteins are metabolized, that can be used as fertilizer and also can become in some industries a waste product. The main focus in this research is to detect the presence of urease activity in metagenomic libraries generated by direct DNA extraction method from El Yunque Tropical Rain Forest (two sites) and Guánica Dry Forest (one site). A total of approximately 18,000 clones were screened from both forest from Puerto Rico. The screened was performance by adding to urea broth media, washed clones with physiological saline from 16 sub-pools from Dry Forest and 4 sub-pools from El Yunque. The inoculated samples were incubated at 37°C from 24-48 hrs, and the presence of a change in color from yellow to pink was scored. There was only one sub-pool, from Tropical Forest positive for the presence of urease activity. The positive sub-pool has around 6,000 clones. Serial dilutions in ELISA plates as well as solid media are being performed in order to isolate the clone or clones with the proposed activity.

**P70**

MACROSCOPIC AND MICROSCOPIC IDENTIFICATION OF A FUNgal-BIOPROSPECT SENSITIVE TO ANTIMICROBIAL AGENTS PRODUCED BY AN UNKNOWN ACTINOMYCETE-BIOPROSPECT.

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Fungi are a large and diverse group of saprophytic eukaryotic organism, with a cell wall made of chitin which produce cellular structure known as hyphae. Fungi are very versatile physiologically, and some of them are pathogens to humans. As the misuse of antifungal substance continues, the number of pathogenic fungi resistance to such antimicrobial agents has also increased. In contrast to bacterial inhibitory substances, anti-fungal agents are hard to obtain, because of the similitude between the fungi’s and mammal’s cells. Actinomycetes are a well-known group of microbes capable of produce antimicrobial substances, but it is important not only to identify the inhibitory agent, but also the microbe that is inhibited. The main focus of this research is the characterization of a filamentous fungus that demonstrated sensitivity to a substance produced by an unidentified Actinomycete isolated in the Microbial Biotechnology and Bioprospecting lab at UPR-Mayaguez. The fungi have been characterized morphologically in the macroscopic and microscopic scale, using Nomarsky, and the Scanning Electronic Microscopy (SEM). Morphologically, the fungi shows a White cotton-like colonies with dark brown concentric region on top, and a pigmented bottom. Also, the colony diameter is approximately 2.20 cm. No exudates were detected. The microscope analysis showed the presence of globular vesicles, flask-shape uniseriate phialides and colorless rough conidiospores. Based on morphological characterization, and the structures identified, the data suggest that the fungi bioprospect belong to the \textit{Aspergillus} genus. There is ongoing research in order to use molecular approach to characterize the bioprospect molecularly.
P71
SURVEILLANCE OF TETRACYCLINE RESISTANCE IN METAGENOMIC LIBRARIES GENERATED FROM TROPICAL RAIN FOREST SOILS IN PUERTO RICO
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To date, most of the knowledge regarding resistance mechanisms in bacteria has been derived studying cultivable microorganisms. Likewise, most antibiotics have been found as secondary metabolites produced by cultivable microorganisms as well. The generation of metagenomic libraries has become a powerful culture independent technique that has facilitated the unraveling of novel activities, including antibiotic resistance. Two years ago, we began functional genomic analyses in tropical rainforest soils in Puerto Rico by generating a metagenomic library from these areas. We also began monitoring for antibiotic resistance by selection of the library on solid media containing ampicillin, penicillin, carbenicillin, spectinomycin, kanamycin, and tetracycline. The presence of a cloned fragment was confirmed by restriction analysis. Though an appreciable number of clones were found, we observed less diversity for clones resistant to tetracycline when comparing restriction patterns to clones resistant to other antibiotics tested. This research focuses on the study of these clones resistant to tetracycline. First, the fosmid’s tetracycline resistance phenotype was confirmed by extraction and re-electroporation of the fosmid in an isogenic strain. Second, in order to identify the gene responsible for the tetracycline resistance phenotype, transposon mutagenesis was used. The transposition reaction was done to the fosmid with the insert in vitro. The mutagenized fosmids were then electroporated into an isogenic host. Sequencing candidates were isolated by detecting loss of antibiotic resistance phenotype using replica plating. Clones were sequenced outwards of the transposon using Tm specific primers. The in silico analysis suggests that the sequences are related or similar to some aminoglycoside and carbohydrate modifiers/inhibitors of microbial origin. In spite of this, the same are low coverage, and primer walking could provide more information about this and other antibiotic resistance genes. We are looking forward to implementing further transpositions and subsequent sequencing to identify these resistance genes.


P72
PURPLE NON-SULFUR BACTERIA ISOLATED FROM TROPICAL FORESTS OF PUERTO RICO AS POTENTIAL BIOPROSPECTS FOR HYDROCARBON DEGRADATION
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Biodegradation of hydrocarbons under anaerobic conditions has not been well studied. However hydrocarbons can be found on environments where oxygen is not available. The purple non-sulfur bacteria, members of Proteobacteria class, have shown the capability of degrade hydrocarbons under anoxic conditions. In previous studies two purple non-sulfur bacteria with the ability of degrade biodiesel, were isolated from the bromeliad’s phytothelmata in two different forests of Puerto Rico. The objective of this research was to identify and study the potential of those bacteria in the degradation of not only biodiesel, but also aromatic compounds such as phenanthrene and naphthalene, and hydrocarbons as diesel and glycerol. The bacteria were incubated in minimal medium at different concentration of these pollutants as sole carbon sources. In addition to this, amplification of the 16S rDNA was performed in order to identify them. The study demonstrated the capacity of both organisms to grow in minimal medium with a concentration of up to 2.0% of each pollutant. This suggests that the bacteria are using these compounds as their source of carbon, which could convert them in bioprospects to be used in the bioremediation field. Analysis of the 16S rDNA gene sequence showed that both bioprospects belong to the genus Rhodopseudomonas sp. with Rhodopseudomonas palustris as the nearest relative. This bacterium is known to use a wide variety of hydrocarbons as carbon source and also present great metabolism diversity. Even though both organisms are related to the same species, morphological and physical data suggest that they are different. Future goals are focused on confirming their hydrocarbons catabolic capability and the full identification of the organisms.
P73
INDUCTION OF SOMATIC EMBRYOGENESIS IN SUGARCANE (Saccharum spp.) IDENTIFIED FOR BIOFUEL PRODUCTION
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Many Scientists have worked on the development of renewable energy. One highly efficient source of energy is a sugarcane variety characterized for its ability to produce biofuel. Germplasm of this variety is very limited in Puerto Rico the traditional method of its propagation is slow, therefore alternate ways of propagation are required. The objective of this project is to optimize somatic embryogenesis in sugarcane. Somatic embryogenesis is the formation of an embryo from somatic cells, this method produces a large quantity of plants in a relatively small area. The sugarcane stalks were obtained from Lajas’ Experimental Station, Puerto Rico. Immature leaves, lateral and apical buds were extracted from the cane and sterilized. In aseptic conditions the explants were transfer to a MS (Murashige & Skoog) medium that contains 2,4-D, antioxidants, agar and different concentrations of coconut water (CW). The explants were kept at dark during callus formation. The contamination of the explants was found to be mainly fungus and affected less than 50% of explants. Callus formation developed generally after one month in the dark. Callus formation was significantly greater in medium containing 5% (v/v) coconut water. Embryogenic callus was induced in two regeneration media one containing 0.5 ppm 2,4-D and 2ppm Abscisic acid (ABA) and the other 5% of coconut water; both media include MS salts and vitamins and were kept in a 16-hour photoperiod. As early as two weeks after the regeneration phase, green outbreaks could be seen in the explants in 5% CW regeneration medium.
This work is partially sponsored by BioMinds

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CHARACTERIZING A SOIL ISOLATED RED PIGMENTED BIOPROSPECT FOR ANTIMICROBIAL AGENT PRODUCTION
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As a consequence of evolution and the excessive exposure of bacteria to many antibiotics, bacterial strains such as Staphylococcus aureus and Enterococcus have emerged as antimicrobial resistant microbes. As a contribution to the solution of the problem, a soil microbial bioprospect with the potential of producing antimicrobial agent was isolated. The main focus of this research is the characterization of a soil microbial isolate, and tests its potential for antibiotic production. The isolate was purified in Luria Bertani media, and the morphology determined macro and microscopically, using light microscopy, Scanning Electron Microscopy and Gram. Molecularly, the DNA of the isolate was extracted using a mechanical method, and the genomic DNA used to amplify the 16S rDNA by PCR. Finally, the amplicon was sequenced, and analyzed in silico. Macroscopically and after growing at 25°C for a week, the isolate colonies were small, red, circular, and convex. After a week, the colony morphology changed to turned undulate, umbonate with a pink pigmentation at their edge and a dark red pigmentation at the center. There was also a presence of a red pigmentation secretion around the colony. The In silico analysis of the sequences suggest that the candidate is an actinomycete that belongs or it is similar to the Actinomadura genus. Ongoing studies are in progress for the complete identification of the isolate, and the detection of antimicrobial agent’s production by the isolate.
P75
CONSTRUCTION OF RETROVIRAL VECTORS TO FUNCTIONALLY DISSECT THE MIR-17-92 ONCOGENIC CLUSTER
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MicroRNAs (miRNAs) are small non-coding ribonucleic acids involved in gene regulation by inhibiting translation by direct cleavage of the target miRNAs through binding with perfect or almost perfect complementarity to the 3' untranslated region. Recent findings illustrate their important role in the regulation of diverse biological processes and indicate the potential influence of miRNAs on almost every genetic pathway. Increased research has provided an insight of their involvement in cellular proliferation, differentiation, and apoptosis in metazoans, humans, mice and other organisms. Recent investigations by He et.al describe a miRNA cluster, the mir-17-92 polycistron, overexpressed in B-cell lymphomas. This miRNA cluster is comprised of the seven miR-17-5p, miR-17-3p, miR-18, miR-19a, miR-20, miR-19b-1 and miR-92-1. Research by He et.al demonstrated that enforced expression of this cluster acted with c-myc expression to accelerate tumor development in a mouse B-cell lymphoma model and prevented the apoptosis of tumors derived from hematopoietic stem cells. However, the individual potential of the six miRNAs in the cluster to accumulate tumor formation is largely unknown. To access this problem PCR amplified primary forms of individual miRNAs were used to produce constructs with the retroviral vector CMSV Sfi A, B T7 ires thCD4-1.ab 1 (human CD4 vector, hCD4). Molecular clones were obtained of miR-17, 18, 19a, 20,1792 and mutated miRNA to unexpress 19a and 92(miR-Δ19 and 1792Δ92). The constructs where produced to express the miRNAs on the cell surface to isolate cells by magnetic labeling through the binding of hCD4 surface proteins and magnetic beads with antibodies using MACS Select System. However, to understand the individual role of these miRNAs further screening and expression assays need to be preformed. Due to the novelty and complexity of miRNAs involvement in cancer progression the quest to solve the microRNA puzzle has just begun.

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DEVELOPMENT OF A NOVEL BIO-FUEL CELL USING COFFE WASTES
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The Coulombic output of a microbial fuel cell was obtained by measurements in a cell with an anodic compartment using coffee waste rich in bacteria (Erwinia Dissolvens). The cathode compartment consists of a 0.2 molar solution of Sodium Phosphate monobasic and dibasic. The microbial fuel cells with and without glucose and with and without mediators was compared in orders to determine the effect of these as a fuel to increase the production of energy. The two compartments were electrically connected with two salt bridges filled with agar saturated with KCl. The electric connection to the voltmeter was made throughout nickel-chromium thin wires sewn to the carbon cloths that were used as electrodes in both compartments. The voltage was measured at closed circuit and also after a known resistance (220 ohm) was connected in series with the instrument. Our results show that adding a small amount of blue methylene mediator (1mL) to the anodic compartment and without adding glucose improved the coulombic output of this novel bio-fuel cell by more than a ten percent (>10%).
P77
EXPOSURE OF SACCHAROMYCES CEREVISIAE TO A LIMITED NUTRITION ENVIRONMENT FOR THE EXPRESSION OF FAP1
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The significance of this research project resides in discovering new insights of TOR’s nutrient pathway and how FAP1 affects these signaling. A new protocol proposed here for the activation of the FAP1 gene will give to us a better understanding about TOR’s functions and regulation of metabolic pathways, thus emphasizing its importance for yeast growth and survival. Experimental objectives include determining the conditions for the maximum expression of FAP1 and TOR1 genes as well as similarities or differences of their expression under limited nutrition environment and rapamycin treatment in yeast. FAP1 is a novel protein, initially found in cultures of Saccharomyces cerevisiae under rapamycin treatment. FAP1 competes in vivo and in vitro with rapamycin for a specific interaction with FKBP-12 and/or FKBP-12:rapamycin complex. FAP1 interaction with FKBP-12 and/or FKBP-12:rapamycin complex activates TORC1, and this activation allows TORC1 to continue its function as a regulator of growth-related pathways. For this reason, the expression of FAP1 gene has been monitored under different stress conditions such as limited nitrogen and carbon sources. These variations in media conditions will mimic the activation of stress-response genes and pathways in yeast. In addition, the use of rapamycin as a positive control for the expression of the FAP1 gene will permit us to compare the levels of FAP1 gene products (protein and RNA) against the different cultures used. A gradual change in color (beige to pink) of the SLAD cultures is due to a normal reaction of yeast to limited nitrogen conditions. Future objectives will include the analysis and subsequent isolation of the three target proteins from crude protein extracts via Western blot, mass spectrometry and co-immunoprecipitation, respectively.

P78
ISOLATION AND CHARACTERIZATION OF RADIATION RESISTANT BIOPROSPECTS FROM HYPERSALINE ENVIRONMENTS AND MICROBIAL MATS FROM CABO ROJO, PUERTO RICO
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Since the discovery in 1956 of the bacterium Deinococcus radiodurans by A.W. Anderson this polyextremophile has been studied due to its ability to survive in extreme environments. This bacterium has served as a model organism in the study of other radiation resistant microorganisms. These radiation resistant microbes could be key in order to develop new biotechnological strategies, such as bioremediation of extremely contaminated and highly toxic environments, and new therapeutic techniques for cancer and other serious illnesses. In this research project UV radiation resistant microbes were isolated from hypersaline soils, mineral rich soils and microbial mats from Cabo Rojo, Puerto Rico. In order to isolate these microbes 6 soil samples went through a series of serial dilutions and the isolates were exposed to UV-C radiation using a laminar flow microbial hood lamp for periods ranging from 5 to 15 minutes. A total of 18 radiocandidates were obtained from the plates exposed to 10 min and 15 min of UV-C radiation. A total of 16 bioprospects were obtained from the hypersaline soil samples and 2 were obtained from the mineral rich soil samples. No bioprospects were isolated from the microbial mat samples. Out of these isolates, 7 went through Gram staining. From these prospects, 5 were gram-negative bacilli, 1 was a gram-negative cocci and 1 was a gram-positive bacilli. Further exposure to UV-C, UV-A and UV-B radiation, spore staining and DNA extraction will be performed in order to further characterize the radiocandidates.
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EXPLORING BACTERIAL DIVERSITY OF FORESTS OF PUERTO RICO USING METAGENOMICS
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From helping animals to digest their food, participate symbiotically with plants and even survive in extreme conditions in ecological mutualism, bacteria are undoubtedly a fundamental part of life. With this knowledge and with the curiosity of identifying the secrets our land conceals, we decided to analyze with culture independent techniques the soil samples from two contrasting environment in Puerto Rico: Guanica dry forest and Yunque tropical forest. Two years ago, metagenomic libraries were generated from these soil samples. Functional analyses have been performed, but the microbial community represented is still unknown. In this research, we attempt to characterize the microbial communities present in the libraries by analyzing the rDNA genes. Two fosmid metagenomic libraries master pool of approximately 40kb insert size and grown in Luria Bertani Media, were extracted using mini preparation technique. The inserts of interest into the fosmids were amplified using 16S rDNA specific primer, and the amplifications were cloned using the TOPO-TA systems. After isolating potential clones and confirming the presence of the inserts of the expected size, the fragments were amplified, and sent to be sequenced further in silico analysis. We have been able to amplify sequences of rDNA clones generated from the metagenomic libraries from both forests and we will be in the process of increasing the number and sequences of rDNA clones generated from the metagenomic libraries in order to unravel the diversity of the soil from both forests.

P80
IDENTIFICATION OF ANTIBIOTIC PRODUCING BIOAGENTS IN THE TROPICS AND HIPERSALINE MICROBIAL MATS OF THE SALINAS DE CABO ROJO IN PUERTO RICO
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Microbial Mats (MM) are laminar organo-sedimentary ecosystems with layers organized base on physiological parameters such light, oxygen or sulfur. The MM layers are: green layer, which is composed of aerobic and photosynthetic microbes, including cyanobacteria, the pink layer, which have mainly anoxyphototrophs bacteria and the black layer with sulfate reducing bacteria among others. Due to the increase of antibiotic resistant microorganisms, there is a need of searching for novel and unique environments in order to discover new antimicrobial agents. The main focus of this research is to find antimicrobial producing cultivable microorganism from the Tropical Hypersaline MM. Samples of MM were homogenized and serial dilutions were performed using 0.85% NaCl. The diluted samples were spreaded on Marine Agar (approximately 2% NaCl), Nutrient Agar (NA), and NA with 50% distilled water and 50% of the water where the MM was collected. The identification of the possible bioprospects consisted in isolating the inhibitor as well as the inhibited bacteria. The inoculated samples were incubated a 25°C and 37°C, and the samples were monitored daily for the presence of inhibition zones. The candidates were purified, and the inhibition activity retested. The general identification of the bioprospects was done microbiologically using Gram stain, and the inhibition tests were done using the radial method. A total of 21 inhibitors and 21 inhibited bacteria were isolated on this study. The Gram staining shows that most of the isolates were gram-negative rods of variable size. The preliminary re-testing of candidates has not confirmed the initial observation, suggestion the possible loss of the activity due to manipulation or nutritional conditions. A new set of sample collection and processing are in progress, as well as modification in the confirmation of inhibition developing a sensor strain.
P81
CHARACTERIZATION OF AL-MG-ZN-B AND AL-ZN-B COMPOSITES
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Al-Zn-Mg-based composites reinforced with AlB₂ particles have been investigated as potential light weight, high strength aerospace materials. Al-0.5wt%Mg-5-6wt%Zn-2%B and Al-5-6 wt%Zn-2%B composites melted in a vibration-enhanced crucible and in a static graphite crucible were characterized. To determine the nature of the phases present in the composite x-ray diffraction tests were performed. Thermal analysis experiments helped assess phase evolution upon melting and solidification, especially to identify the phases affected by the vibrations. Conventional microscopy and scanning electron microscopy allowed further characterization of the resulting microstructure. Additionally, selected variables as grain size and the mean distance between reinforcements were assessed to determine the effect of the melting process on those parameters relevant to the final mechanical response of the composites.

P82
TWO NOVEL DISTRIBUTION-FREE METHODS FOR CANCER DIAGNOSIS THROUGH MICROARRAY ANALYSIS
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Cancer diagnosis through the study of differential genetic expression behavior in comparative studies has been the focus of research within microarray analysis. The inherent interdisciplinarity of the field calls for the creation of very sophisticated analysis tools by experts in algorithmic development, resulting in effective methods. The final users of these same methods -physicians and biologists-, however, might end up with a 'black-box'. The search for techniques that are effective, yet somewhat transparent for the final users has led our research group to explore the use of nonparametric techniques. Cancer diagnosis in microarray analysis can be understood as the problem of tissue classification when a tissue is characterized by its differential gene expression levels. Starting with the application of the Mann-Whitney test for median comparison as a baseline approach, a series of modifications have been introduced to improve tissue classification for cancer diagnosis. This work details two of the resulting nonparametric methods as well as their promising results for tissue classification.

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CLASSIFICATION PROBLEMS: VEHICLE CLASSIFICATION AND MICROARRAY ANALYSIS
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Automatic classification plays an important role in many applications in Engineering and the Sciences. Artificial Neural Networks have been used as universal approximators, classifiers, clustering tools, among others. In this work, the use and performance of Artificial Neural Networks are compared to those of Linear Discriminant Analysis in classification. The former are capable to create nonlinear classifiers and hail from the Artificial Intelligence literature while the latter can create classifiers of at most quadratic nature and has its origin in Statistics. The comparative assessment will be carried out based on two applications: classification of passing vehicles based on electronic imaging and diagnosis of cancer based on microarray data.

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THERMOMECHANICAL CHARACTERIZATION OF Al-Cu-Mg COMPOSITES REINFORCED WITH DIBORIDE PARTICLES

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Aluminum-based composites have been evaluated for aerospace and transportation applications where lightweight and appropriate strength at high temperatures are key requirements. The present work focused on the study of the mechanical response of a series of Al matrix composites at high temperatures. The composite matrix contained 2.5 wt. % Cu and 1 wt. % Mg and was reinforced with different levels of boron (0, 1, 2, 3 and 4 wt. %) forming AlB2 particles. The specimens, fabricated via gravity casting, were tested using a thermo-mechanical analyzer under constant compression loads to reveal the composite hardness and their response under creep conditions. Additionally, the composites were tested using a dynamic mechanical analyzer to corroborate their creep behavior. These experiments were conducted at 470ºC under an applied compression load of 10N. Our results indicated that even at 300ºC higher concentration of diboride particles helped the composite retain high hardness and effectively reduced the compressive creep strain compared to an unreinforced alloy with similar concentrations of Mg and Cu.

P85
MULTIPLE CRITERIA OPTIMIZATION FOR MICROARRAY ANALYSIS: BIOMARKERS SEARCH

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Since their appearance, microarrays have become an extensively used tool for screening those genes that significantly change their relative expression between different states and, specifically, for the identification of biomarker genes. A biomarker is a gene whose expression change can be taken as an indicator or a predictor of a particular state e.g. cancer. In the study of cancer, biomarkers have been discovered and used for many purposes including diagnosis and prognosis as well as prediction of recurrence of the illness among others. In the identification of potential biomarkers through microarray data analysis, albeit an active research area, it remains a challenge to have a method that is effective and, at the same time, independent of the users' ability and training. In this work, it is proposed that biomarker identification can be casted as a Multiple Criteria Optimization problem (MCO). Solving an MCO problem results in a set of solutions representing the best compromises among all the criteria considered in the analysis. These solutions are called Pareto-efficient solutions and they conform a so-called efficient frontier of the problem. This work proposes that genes on the resulting efficient frontier of an associated MCO problem could be cancer biomarkers. Among the methodologies used to solve MCO problems, Data Envelopment Analysis (DEA) has been chosen in this work given their parameter independence in many of its formulations. In this work two microarray databases from different cancer types are considered, results from their statistical analysis are used as conflicting criteria. The resultant efficient genes had been validated in literature as relevant for metabolic processes related to cancer. Results encourage further exploration of the proposed methodology considering different experimental designs using one, two or more microarray databases. Authors acknowledge the support of the Department of Industrial Engineering at UPRM for the assistantship of M. Sánchez, as well as the founding of the BioSEI Project 33 010 3080 301 granted by Cabrera-Ríos and PROMEP project 103.5/07/2523 granted by Isaza C.E.
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STATISTICAL CHARACTERIZATION AND OPTIMIZATION OF MAGNETIC PROPERTIES OF CO-ZN FERRITE DOPED WITH GADOLINIUM.

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Co0.7Zn0.3Fe2-yGdyO4 Ferrite has high temperature of demagnetization of 350 degC, but when substituted with Gd, it becomes an attractive candidate for magnetocaloric applications. For such applications, ferrite must achieve low coercivity (Hc), high magnetization (Ms), and high pyromagnetic coefficient. Co0.7Zn0.3Fe2-yGdyO4 ferrite with “y” varying from 0.01 to 0.03 was prepared by co-precipitation. Molarities, concentrations of the metal salts and precipitant agent (NaOH), as well as flow rates of addition of the metal salts affect the structural and magnetic properties of this ferrite. Application of experimental design concepts to study the synthesis procedure will help to characterize the effect of the variables involved. This characterization will then be used in an experimental optimization scheme to search for the best compromises of the desired magnetic properties. The results of this series of studies are discussed in the context of experimental design.

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EFFECT OF ACOUSTICALLY-INDUCED CAVITATION ON THE PERMEABILITY OF SOFT TISSUES

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Ultrasound has been shown to enhance drug delivery through tissue and cell membranes. The mechanisms involved on this phenomenon are not clearly understood, but ultrasonically-induced cavitation bubble dynamics play a fundamental role. It has been shown that under certain conditions ultrasonically-induced cavitation can cause a transient permeability increase. In order to understand this effect, a well-controlled ultrasound field is used to produce spontaneous cavitation on a specific location. An acoustic chamber with a piezoelectric material provided the required standing acoustic pressure field (on a degassed liquid media) needed for a local cavitation on the immersed tissue.

In order to determine the effect of ultrasound on the tissue and cell’s membranes, a DNA (deoxyribonucleic acid) stain such as propidium iodide (PI) will be used. PI is impermeable to the cell membrane; therefore, it will only stain the cell’s nucleus if the cell membrane was damaged during ultrasound exposure. Imaging techniques will be used to evaluate the damage on the tissue’s cells.

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MICROFLUIDIC TECHNOLOGY FOR HIGH THROUGHPUT SINGLE-CELL ELECTROPORATION

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Electroporation is a technique commonly used in the fields of biology and biotechnology to introduce foreign molecules into the inner compartments of biological cells. It’s considered a “brute force” technique since half of the treated population can be lysed during the process and the transfection efficiency can be as low as 10%. Micro-electroporation has been getting a lot of attention by the scientific community because it circumvents the drawbacks of conventional cellular electroporation by targeting one cell at a time in a controlled fashion. However, this improved performance comes at a price, low throughput. This project aims at the fabrication and testing of a new generation of micro-electroporation devices based on polydimethylsiloxane (PDMS) microchannels. The design concept of the microfluidic channel is to trap biological cells in a flow restriction target zone in a flow through setup. This microfluidic electroporation device is designed to conserve the good features of micro-electroporation while attaining high throughput.
HYDRODINAMICALLY INDUCED WHOLE-CELL MANIPULATION IN MICRO-FLUIDICS DEVICES
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The increasing interest for dedicated analysis of single particles at microscopic scales, such as biological cells, has led researchers to create micro-fluidic systems capable of trapping particles in a liquid flow. The present study evaluates the possibility of using a pressure difference trapping mechanism to overcome the limitations of systems based on physical obstructions as the trapping mechanism. Also, implement a detection system using electrical signals to eliminate the need of optical instruments.

The proposed micro-fluidic device is fabricated using soft lithography and consists of parallel canals that are linked by small apertures that function as localized pressure-gradient traps. Computational models using COMSOL have shown that, depending on the geometry of the channels, a significant pressure difference can be achieved at the trap sites. Experiments with 2um fluorescent polystyrene beads showed that the beads follow a streamline trend almost identical to the one predicted by the COMSOL models. Another set of experiments using 20 um beads demonstrated that the apertures were capable of trapping and retaining particles by the introduction of one constant flow through one of the channels. In addition, if the flow was introduced through the other channel, the trapped beads were released to the bulk flow. These preliminary findings indicate that the proposed micro-fluidic devices can serve as a smart platform for the trap-and-release of suspended single cells for analysis and treatment by the injection of constant pressure driven micro-flows.

Future work will include variation of flow rate configuration to find optimum operational parameters for existing devices and propose future designs to increase pressure differentials at the trapping sites and packaging efficiency based on computational simulations. Thanks to National Nanotechnology Infrastructure Network (NNIN), Laboratory Experience for Faculty at Cornell Nanoscale Science and Technology Facility (CNF), UPRM and Purdue University Collaboration in Biomedical Engineering Research (CIBER), and the Amgen Bio-Minds Program.

RELATIONSHIP BETWEEN PSYCHO-EMOTIONAL PROBLEMS AND PSYCHOLOGICAL WELL BEING AMONG STUDENTS OF THE UNIVERSITY OF PUERTO RICO AT MAYAGÜEZ CAMPUS
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The objective of the study was to determine the relationship between psycho-emotional problems (P-EP) and psychological well being (PWB) among students at the University of Puerto Rico-Mayagüez Campus. P-EP was defined by the presence of depression and anxiety symptoms, as well as general psychiatric symptoms. According to the NIMH (2008), psychological well being implies a mental processes that result in the capability to: 1) carry out productive activities; 2) establish and maintain satisfactory interpersonal relationships, 3) adapt and adjust to varied situations and, 4) deal with difficulties using suitable or effective management strategies. The sample of the study consisted of 543 undergraduate students (63.5% female and 36.5% male) randomly selected. The instruments used in the study were: CES-D, LCS-36, BAI, and PWB. Preliminary analysis supports the presence of anxiety (mean= 10.55, sd= 8.9), depression (mean= 16.23; sd= 9.6) and general psychiatric symptoms (mean= 59.96, sd= 20.51) among the sample. Correlation coefficients between the measures of PP and PWB will be calculated. Study results’ will be discussed considering the relevance to offer workshops on psycho-emotional problems (identification of symptoms and coping strategy) and psychological well being (and associated factors) for college students.
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STRONG KIDS: SOCIAL TRANSFORMATION IN THE CLASSROOM
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The goal of the present study was to examine the effectiveness of the Spanish translation and Puerto Rican adaption of the “Strong Kids” (Niños Fortalecidos) Curriculum (ref). The importance of teaching the indicated skills is based on the idea that youth who are socially and emotionally healthy will be better prepared to face academic challenges as well as overcome social and personal obstacles. The curriculum comprises 12 lessons that cover themes from recognition of one’s own emotions to learning how to recognize feelings in others. Twenty-three students between the ages of 11 and 13 years were recruited from an elementary school in the north eastern part of the island. The intervention with these students consisted of the presentation of 12 lessons directed toward the development of social emotional skills and resilience. During the initial lesson, all participants completed a pre-test included in the curriculum. This pre-test evaluates both psychological symptomology and social skills knowledge. Subsequent to finishing the final lesson, each participant completed a post-test of psychological symptomology and social skills knowledge that consists of the same items as the pre-test. Results indicated that students who received “Strong Kids” demonstrated a significant increase in knowledge of healthy ways to relate to others vs. inappropriate was of expressing feelings, thoughts, and behaving (t=19.385, p<.01). Furthermore, a significant reduction in the presentation of internalizing and externalizing symptoms was observed (t=10.072, p<.01). In conclusion, the creation of programs including “Strong Kids” offers the opportunity for school psychologists to strengthen and expand as a discipline that addresses behavior social and mental health within a school setting. Furthermore, in political-administrative terms, these types of programs offer psychologists the opportunity to create socially transformative instruments that help better society.

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COPING STRATEGIES IN DEAF PERSONS FROM THE NORTHWEST AND WEST OF PUERTO RICO
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The coping strategies are ways to manage stressful, internal or external events (Lazarus & Folkman, 1984; Taylor 1998). With the identification of these strategies, in a group that has been barely studied as the Deaf Community is, intervention and prevention programs, therapies, or workshops can be created for a better personal, social, academic, and professional development in this individuals. This investigation was design to explore the following purposes: 1) to describe the most frequently used coping strategies by a sample of deaf persons in Puerto Rico, 2) to identify gender differences use of coping strategies; and 3) to evidence the internal reliability of the instrument with the studied population. The sample consisted of 30 participants, who completed a consent form, a sociodemographic questionnaire and the Spanish Version of the Brief-Cope Questionnaire. Descriptive statistical analysis and internal reliability tests were conducted. Main results supports that the most frequently coping strategy used was the acceptance and the religion. The internal reliability of the instrument was adequate (Chronbach Alfa of .73). Because of the findings, we can say that the strategies being used are positive, but with workshops, programs or therapies developed to impact this group, those strategies might improve and further strengthen their capability to manage stressful events. A biggest sample would be adequate to know more about this group and how they cope within a variety of situations.