



# XXIV Sigma Xi Poster Day

Saturday, May 8<sup>th</sup>, 2021  
9:00 am to 9:00 pm

Virtual Community, UPR-Mayagüez



## Book of Abstracts



# **XXIV Sigma Xi Poster Day**

**presented by**

**Sigma Xi, The Scientific Research Society**

**Mayagüez Chapter No. 511**



**Saturday, May 8<sup>th</sup>, 2021**

**9:00 am to 9:00 pm**

**Virtual Community, UPR-Mayagüez**

**Prepared by 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 in 1886: 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.

## **POSTER DAY ORGANIZING COMMITTEE**

Dr. Carmen A. Vega Olivencia, Department of Chemistry \*

Dr. Carlos Ríos Velázquez, Department of Biology \*

Dr. M. Laura López Moreno, Department of Chemistry \*

Dr. Aidalú Joubert Castro, Department of Chemistry \*

Dr. Emilio Díaz Morales, Department of Chemistry \*\*

Mr. Josian Luciano Velázquez, Department of Chemistry \*\*\*

\* faculty    \*\* faculty, retired    \*\*\* graduate student

## **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, the Center of Information and Technology, and members of the Departments of Biology and Chemistry. 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.

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## POSTERS

### P1

#### **LASMENIA SPP. HONGO CAUSANTE DE NECROSIS FOLIAR EN MANGO (*MANGIFERA INDICA*)**

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Una de las especies más importantes dentro de la familia Anacardiaceae es el mangó, *Mangifera indica* L. Este cultivo es exportado a Estados Unidos y a países europeos como un producto de primera calidad, pero enfrenta problemas asociados a hongos fitopatógenos y plagas insectiles que; afecta la producción local. Por lo cual, el objetivo de esta investigación fue identificar al agente causal asociado a una necrosis en tejido foliar y frutos. Se seleccionaron cuatro diferentes morfotipos de hongos luego de varios aislamientos a partir de tejido vegetal recolectando en la colección de germoplasma de mangó de la EEA de la UPR, Juana Díaz y de una finca comercial en el sur de Puerto Rico. Se examinaron sus características morfológicas microscópicamente y se identificó a *Lasmenia* spp. Este hongo presenta crecimiento micelial que varía en color de crema a salmón con anillos concéntricos de color marrón a negro. Los conidios son hialinos, unicelulares producidos en un acérvulo y tienen un promedio de 2.94  $\mu\text{m}$  de largo y 1.30  $\mu\text{m}$  de ancho. Además, se realizó la caracterización patogénica para un morfotipos utilizando árboles de mango en viveros, completándose los postulados de Koch. Los síntomas observados fueron necrosis en el tejido foliar, característico de este hongo. En Puerto Rico, *Lasmenia* spp. se ha identificado como el agente causante de necrosis en raquis, aborto de flores, pudrición de frutos y manchas foliares en rambután. Este sería el primer reporte a nivel mundial de *Lasmenia* spp. afectando el tejido de mangó.

### P2

#### **LASIODIPLODIA THEOBROMAE Y COLLETOTRICHUM QUEENSLANDICUM, PATÓGENOS DEL FOLLAJE DEL PANAPÉN (*ARTOCARPUS ALTILIS*) EN PUERTO RICO**

González Rodríguez, Daniel<sup>1</sup>, Soto Ramos, Casiani<sup>2</sup>, Simbaña, Lorena<sup>3</sup> y Rivera Vargas, Lydia I.<sup>4</sup>

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*Artocarpus altilis* (Moraceae), es un árbol frutal de origen tropical reconocido globalmente por su valor cultural, alta producción de frutos y potencial de refinamiento. A nivel mundial se han documentado reportes de patógenos y enfermedades, sin embargo, en el Caribe estos estudios han sido limitados. A partir de esto, los objetivos de este estudio se dirigieron a la identificación y caracterización de agentes patogénicos de *Artocarpus altilis* en Puerto Rico. En el 2018 se observaron síntomas de etiología desconocida en predios de panapén localizados en las Estaciones Experimentales de Lajas e Isabela de la UPR. Los síntomas foliares observados fueron manchas anulares necróticas irregulares en los márgenes y en ambos lados de la hoja. Se identificaron los géneros de hongos: *Lasiodiplodia* spp. y *Colletotrichum* spp. luego de su aislamiento a partir de tejido sintomático, utilizando claves taxonómicas. Las colonias de *Lasiodiplodia* spp. produjeron micelio aéreo de color gris, tornándose negro con el tiempo. Inicialmente los conidios inmaduros fueron hialinos, unicelulares de forma ovoide. Al madurar, los conidios se tornaron marrón oscuro, bicelulares con líneas estriadas. Las colonias de *Colletotrichum* spp. produjeron micelio algodonoso blanco con acérvulos y masas de conidios de color salmón. El tamaño de los conidios (n=30) de *Lasiodiplodia* sp. promediaron 30.68 x 18.96  $\mu\text{m}$  (largo x ancho), mientras que los de *Colletotrichum* sp. fueron de 11.65 x 3.58  $\mu\text{m}$  (largo x ancho). Las pruebas de patogenicidad realizadas en árboles a nivel de vivero demostraron sintomatología patogénica con los aislados evaluados y se completaron los postulados de Koch. Se observó el desarrollo de picnidios en tejidos vegetales afectados por *Lasiodiplodia* sp. y exudados de color naranja producidos conteniendo masas de conidios de *Colletotrichum* sp. Los árboles control



no presentaron síntomas. La identificación molecular fue realizada mediante análisis de secuenciación de ADN para ambas especies utilizando los genes ITS4/ITS5, Bt2a/Bt2b, EF688/EF1251, LROR/LR5 para *Lasiodiplodia* sp. e ITS-1F/ITS-4, T1F/T2R, GSF/GSR, ACT-512F/ACT-783R, HIS CYCLIN 3F/HIS CYCLIN-1b, GDF/GDR, CHS-79F/CHS-34R y SODglo2-F/SODglo2-R para *Colletotrichum* sp. Se identificaron las especies: *Lasiodiplodia theobromae* y *Colletotrichum queenslandicum* del tejido vegetal colectado en Lajas e Isabela, luego de comparar las secuencias con la base de datos del GenBank. Ambas especies han sido identificados como patógenos importantes causantes de epidemias como antracnosis, muerte regresiva y canchales en ramas en un rango de cultivos tropicales. Este es el primer reporte de *Lasiodiplodia theobromae* y *Colletotrichum queenslandicum* afectando follaje de panapén en Puerto Rico y el Caribe.

### P3

#### **BOTRYOSPHAERIACEAE EN VARIEDADES COMERCIALES DE MANGÓ EN PUERTO RICO**

*Quimbita Reyes Alexis M.*<sup>1</sup>, *Rivera Vargas Lydia I.*<sup>2</sup>, *Soto Ramos Casiani M.*<sup>3</sup>,  
*Garay Rodríguez Gustavo A.*<sup>4</sup>

<sup>1</sup>Estudiante graduado, <sup>2</sup>Catedrática, <sup>3</sup>Investigadora Asistente y <sup>4</sup>Estudiante subgraduado, Departamento de Ciencias Agroambientales, Colegio de Ciencias Agrícolas, Universidad de Puerto Rico - Mayagüez.

El mangó (*Mangifera indica* L.) es una de las frutas comerciales más importantes de Puerto Rico, aportando \$25.3 millones al Ingreso Bruto Agrícola (FY 2014-2015). Una de las enfermedades de mayor impacto en el rendimiento y producción del mangó es la muerte descendente, ocasionada por hongos pertenecientes a la familia Botryosphaeriaceae. Una de las limitantes en la identificación de estos hongos es la ausencia de estructuras de reproducción en medio de cultivo. Por tal razón, el objetivo principal de esta investigación fue caracterizar morfológicamente hongos pertenecientes a dicha familia. Los hongos fueron aislados de dos variedades comerciales de mangó: Keitt y Palmer. Se recolectó tejido sintomático en dos localidades al sur de Puerto Rico durante septiembre y noviembre del 2019. Las muestras se aislaron en medio de agar de papa y dextrosa (PDA), y se incubaron durante 5 días a 25°C. Los síntomas observados fueron: muerte descendente, gomosis, y necrosis en diversos órganos. Se seleccionaron 32 (25%) y 34 (39%) aislados con crecimiento micelial distintivo de esta familia, para el primer y segundo muestreo, respectivamente. Los aislados se clasificaron en ocho morfotipos, basándonos en el cambio de coloración micelial en PDA cada 4 días. También se desarrollaron curvas de crecimiento. Los morfotipos presentaron cambios de tonalidad micelial desde blanco, gris-verdoso, gris oscuro a negro. Las curvas de crecimiento mostraron que los morfotipos completaron su crecimiento en PDA luego de 2 días. Estableciendo de esta manera, dos patrones en la tasa de crecimiento micelial, así como seis patrones de coloración. Entre las proyecciones futuras, se propone determinar la patogenicidad y analizar diferentes regiones génicas que nos permitan identificar las especies de hongos envueltas.

### P4

#### **RELATIONSHIP BETWEEN HIP AND WITHERS HEIGHT IN SLICK AND WILD TYPE-HAIRED PUERTO RICAN FEMALE HOLSTEIN CALVES**

*Colón Rodríguez, I., Domenech Pérez, K., Cruz González, N., Pérez Rosario, N., Ramos Gerena, A., Vega Martínez D., López Colón, J. and Sánchez Rodríguez, H.*

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Withers height (WH) has been widely studied as a predictor of body weight in cattle because it is a direct reflection of the skeleton. However, there are other bone structure limited dimensions (such as the hip height; HH) that, if related to WH, may successfully predict body weight. Thus, the current study aimed to evaluate the relationship between WH and HH in 10 slick and 9 wild type-haired Puerto Rican female Holstein calves. Calves' hair coat groups (balanced by sire) were visually selected at birth. Data (HH and WH) were recorded weekly during the

first 8 weeks of age (pre-weaning period) and then monthly, during 10 consecutive months (post-weaning period). During the pre-weaning stage, whole milk (6 L/calf/day; 26% CP and 28% fat; DM basis), starter (22% CP and 3% fat; DM basis) and water were provided. Starter (2 kg/heifer/day) and *ad libitum* access to hay and water were provided during the post-weaning period. Data were analyzed by GLIMMIX, CORR and REG CORR procedures of SAS. There were no interactions between hair coat type and sampling affecting calves' HH ( $P=0.7412$ ) or WH ( $P=0.4637$ ) measurements. Neither were differences between the slick and wild type-haired groups in HH (averaging  $90.37\pm 1.33$  and  $90.72\pm 1.39$  cm, respectively,  $P=0.8586$ ) or WH (averaging  $90.00\pm 1.35$  and  $90.04\pm 1.41$  cm, respectively,  $P=0.9860$ ) measurements. The HH and WH increased an average of 39 and 45 cm between birth and 18 months of age ( $P<0.0001$ ). The HH and WH data were positively correlated ( $r=0.98$ ;  $P<0.0001$ ). Through the pre-weaning period the relation between HH and WH was linear in the slick ( $HH=0.82WH+17.49$ ;  $R^2=0.70$ ;  $P<0.0001$ ) and in the wild type-haired heifers ( $HH=0.82WH+17.52$ ;  $R^2=0.75$ ;  $P<0.0001$ ). Likewise, there were linear relationships between HH and WH during the post-weaning period in the slick ( $HH=1.06WH-1.33$ ;  $R^2=0.97$ ;  $P<0.0001$ ) and wild type-haired heifers ( $HH=1.02WH+2.12$ ;  $R^2=0.95$ ;  $P<0.0001$ ). The HH and WH are highly associated body dimensions. Thus, HH may represent a reliable option to estimate BW in Puerto Rican slick and wild type-haired Holstein calves and heifers.

## P5

### THE USE OF HEMATOXYLIN AND EOSIN MUSCLE STAINING AND IMAGEJ AS TOOLS TO ASSESS THE INCIDENCE AND SEVERITY OF WHITE STRIPING IN CHICKEN BREASTS

*Dones-Ortiz, C., Domenech-Pérez, K., Sánchez-Rodríguez, H., Torres-Burgos, Y., Torres-Ruiz, W., and Peña-Alvarado, N.*

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The myopathy known as white striping (WS) is an alteration that increases the deposition of fatty tissue in the breast muscle (*Pectoralis major*) of high yielding broiler chickens. The condition poses a significant threat to the poultry industry as it changes the appearance of important poultry cuts which decreases consumers' willingness to purchase. Macroscopic (objective visual scoring) and microscopic (histological staining) methods have been used to determine the presence and severity of WS. However, a comparison of the effectiveness and usefulness between them needs to be assessed in order to evaluate which one is more adept. Thus, a subsampling from an existing trial evaluating the effects of growth rate (rapid or slow) and L-carnitine supplementation (0 or 100 mg/mL) was used to compare both methodologies. A total of 144 broiler chickens were biopsied on the left cranial ventral region of the *Pectoralis major*. Histological slates were prepared and stained (hematoxylin and eosin; H&E), photographed in triplicates ( $n=432$ ) using microscope photography technology (Nikon Eclipse TS100), and analyzed using ImageJ software (v. 1.31). Data were analyzed (Proc GLIMMIX, SAS; version 9.3), and the relationship (Proc CORR) between the visual assessment and histological methods were evaluated. No significant interaction between growth rate and L-carnitine supplementation was observed for any of the response variables ( $P>0.05$ ). Rapid growth rate was seen to increase average cell size ( $P=0.0315$ ) and percentage adipose tissue relative to muscle cells ( $P=0.0007$ ), while cell count ( $P=0.0171$ ) was greater in slow growth birds. Increased incidence and severity of WS was visually observed in birds with rapid growth rate ( $P<0.0001$ ) and supplementation with 100 mg/mL of L-carnitine ( $P=0.0348$ ). Also, a significant ( $P=0.0043$ ) weak correlation ( $r=0.2375$ ) was found between visual assessment and percentage of adipose tissue relative to muscle cells. Although the study showed that microscopic image analysis with H&E staining was useful in determining presence and severity of WS, it is labor and cost intensive relative to subjective visual assessment which comparatively is more resource efficient.

## P6

**RABBIT'S FEED INTAKE AND RELATE PRODUCTION COSTS IN PUERTO RICO***Tosado Martínez, T., Domenech Pérez, K., and Sánchez Rodríguez, H.*

Department of Animal Science, UPR-Mayagüez

Feeding represents the greatest cost in any animal production scenario, accounting for 60-80% of total production costs in rabbit farms worldwide. However, to the authors' knowledge, such costs have not been evaluated in Puerto Rico's (PR) rabbit industry. Thus, the current study evaluated the feed intake and associated costs of rabbit production in PR. Experimental rabbits were obtained from Californian does mated to a New Zealand Red (NZR; n=21; from 3 does) or a Flemish Giant buck (FG; n=31; from 4 does). Weaning and sexing were carried out at 21 and 42 days of age, respectively. Rabbits had *ad libitum* access to commercial concentrate feed (17% crude protein) and water and were harvest at 91-93 days of age. Weekly individual feed intake was determined by the following equation ((offered feed – rejected feed) / rabbits per cage). Concentrate feed cost was \$0.53/kg. Feed intake and cost related data were determined. Total feed intakes per rabbit of 10,117.84, 8,907.82, 9,075.37, and 9,486.99g were observed in the NZR females, NZR males, FG females, and FG males, respectively. Such feed intakes represented concentrate feed costs of \$5.36, \$4.72, \$4.81, and \$5.03 in the respective rabbit groups. The amount of feed required to produce 1 kg of rabbit meat using NZR females, NZR males, FG females, or FG males was 4.28, 3.99, 3.44, and 3.49 kg, respectively. Assuming that feeding represents 80% of total costs, this is translated to total production costs of \$2.83, \$2.65, \$2.28, and \$2.31 for each kg of rabbit meat produced by the NZR females, NZR males, FG females, and FG males, respectively. The current study provides an idea about the production costs of rabbit meat in PR. These values should be taken into consideration when establishing the sale value of this product.

## P7

**DISTRIBUTION AND ALLELE FREQUENCY OF THE GLN3060X VARIANT PRESENT IN THE ASPM GENE ASSOCIATED TO MICROCEPHALY AND RELATED DISORDERS IN PUERTO RICO**

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Microcephaly is a disorder that affects brain-development, resulting in neonates with a smaller head-circumference than expected, generally 3-4 SD below the mean depending on age and gender. The main focus of this research project is the condition **Primary Hereditary Microcephaly (MCPH)**, microcephaly discovered before birth that is commonly caused by genetic factors. Although many genes have been identified as risk factors for MCPH, mutations in the ASPM gene are known to be the biggest risk factor associated with primary microcephaly. The ASPM gene is known to play a very important role in mitotic division during neurogenesis in a developing brain. Therefore, a mutation in this gene could be the cause of Microcephaly or conditions commonly related to it. The particular variant being studied is Gln3060X, a missense variant of the ASPM gene previously associated with primary microcephaly. A general population study in Puerto Rican population was done using an array of 625 DNA samples from healthy individuals evenly divided by 30 municipalities around Puerto Rico. The variant was tested using the ViiA 7 Real Time PCR system, using TaqMan and the particular SNP (rs137852994) for the Gln3060X variant. Among these 625 samples, 62 mutated individuals were found; 61 heterocigotes (G/A) and 1 homocigote (A/A). In total, this study found an approximate 5% allelic frequency of the Gln3060X mutation in Puerto Rican population. Therefore, we can confirm the presence and prevalence of this mutation in Puerto Rico, mainly concentrated among North and East regions of the Island. Furthering the project, patients that suffer from Microcephaly and related conditions will be collected to participate in the study to prove allelic frequency in patients that suffer from them, meanwhile associating this variant with the development of Microcephaly and other conditions in Puerto Rico.

## P8

**REPRODUCTION OF THE INVASIVE *BOA CONSTRICTOR* IN PUERTO RICO**

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**Abstract-** Invasive species play a significant role in negatively altering their newly found environment as well as the ecosystem they inhabit. A broad increase in their populations has generated: extinction of wildlife species, habitat degradation, infrastructure damage, and impact on human health. The given rise in their population has led this study to retrospect and analyze the reproductive anatomy of both the female and male *Boa constrictor*. Where analyzing their reproductive mechanism, portrays a clearer vision into their accelerated expansion. This was observed by using the different parameters available to determine their reproductive maturity. In the case of a female, a thickened oviduct and / or follicles were identified. For males we checked the epididymis and measured the left testicle. We found a correlation between the SVL of both males and females and their reproductive maturity. An increase in body size meant an increase in reproductive maturity, thickened oviduct in females and convoluted epididymis in males. Furthermore, we found a directly proportional relationship between the number of follicles presented in females and their SVL. This study shows that the species is actively reproducing on the Island.

## P9

**EFFECTS OF NANO-BUBBLES ON STATIONARY GROWTH OF FUNGI AND BACTERIA**

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Nano-bubbles are small bubbles of approximately 100 to 200 nm that help oxygen distribution in solutions. They remain in water for several months essentially preventing the loss of oxygen from the medium. The properties of nano-bubbles include long term stability, negative zeta potential and generation of free radicals. In this study, fungi and Gram-negative bacteria were grown in selected media with different concentrations of nano-bubbles. Fungi *Trichoderma spp.* (KBM\_1Δ) and *Purpureocillium lilacium* (KBM\_3Δ) and bacteria *Escherichia coli* and *Salmonella spp.* were inoculated in a minimal defined medium containing dextrose as the sole carbon source and grown at room temperature. Dried fungal biomass was recorded after filtration, oven drying at 60°C and weighing the samples after 7 days of growth. Bacterial growth was determined by optical density after 24 hours. Effects on microbial growth of different nano-bubbles concentrations in bacteria (E11, E9) and in fungi (E11, E10, E9) were compared between treatments and a study control with a minimum medium prepared with distilled water. Data were analyzed using graphics and ANOVA. *Trichoderma* biomass reached 97.4 mg and *Purpureocillium lilacium* was 77.6 mg, both in minimum medium. The ANOVA results showed that the growth of nano-bubbles on fungi are not statistically significant ( $p > 0.05$ ). In the case of bacteria, the p-value was statistically significant for *E. coli* (0.045582) and for *Salmonella* (5.02E-06) both in nano-bubbles concentration of E9. Fungi, in general, showed no effects in cultures supplemented with nano-bubbles, but bacteria showed difference in growth under different treatments.

**P10**  
**DISTRIBUTION AND FREQUENCY OF THE VARIANT rs10738445 OF BNC2 GENE ASSOCIATED TO IDIOPATHIC SCOLIOSIS IN PUERTO RICO**

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Idiopathic Scoliosis is a deformity of the spine, due to the growth of the person, shaped like an “C” or “S”; at a minimum Cobb angle of 10°. Recent studies have found a susceptibility allele (rs10738445) that increases the expression of the BNC2 gene and is expressed as a homozygous for CC. The BNC2 protein is present in the myoblasts and uterus, spinal cord, bone, and cartilage tissue. Thus, suggesting that there is a relationship between the increase in the gene and the etiology of Idiopathic Scoliosis. Other findings suggest a functional role for BNC2 in the development and progression of spinal deformity in patients with Idiopathic Scoliosis. The rs10738445 of the BNC2 gene appeared, in the worldwide genomic study 1000 Genomes Project, in Puerto Rico with a genotypic frequency of 53% for the homozygous CC. Using RT-PCR, 622 samples of the general population of Puerto Rico are going to be genotyped for the SNP rs10738445. Once all the results are obtained, the genotypic frequency of the population will be calculated. At the end of the investigation, we obtained that for the genotype CC of rs10738445 has a population frequency of 5.9% in Puerto Rico, with a higher prevalence in the western area.

**P11**  
**ISOLATION AND CHARACTERIZATION OF SPECIFIC BACTERIOPHAGES FOR PSEUDOMONAS AERUGINOSA AND STAPHYLOCOCCUS AUREUS FROM WASTEWATER FROM A TREATMENT PLANT IN MAYAGÜEZ, PUERTO RICO**

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*Pseudomonas aeruginosa* and *Staphylococcus aureus* are multidrug resistant pathogenic bacterium considered by the CDC as a serious threat with urgent treatment needs. Carbapenems are last resort broad-spectrum antibiotics used to treat resistant bacteria. However, resistant strains produce carbapenemases to evade antibiotics making them difficult to treat. An alternative treatment that has been revisited experimentally involve the use of phage therapy (PD), which employs the specificity and bactericidal properties of bacteriophages to target specific strains. This research seeks to isolate *P. aeruginosa* and *S. aureus* bacteriophages. Given these bacteria are found in wastewaters and bacteriophages can survive with their host, samples from a wastewater treatment plant in Mayagüez, Puerto Rico were collected and used as sampling sites. To increase the bacteriophages concentration, an enrichment was performed by inoculating wastewaters filtrate with their respective hosts (*P. aeruginosa* (ATCC 19660) and *S. aureus* (ATCC 25923)), after amplification, the presence of the phages was confirmed using bacterial lawn-spotted test and plaque assays. Bacteriophages were successfully isolated, being necessary to dilute the sample to  $10^{-6}$ - $10^{-12}$  to avoid concurrent lysis in the plaque assay. The estimated bacteriophages in the lysate of *P. aeruginosa* was  $2.5 \times 10^{12}$  pfu/mL, and the average diameter of the plaques ranged from 0.8 to 1.0 mm. However, the estimated bacteriophages in the lysate of *S. aureus* was  $1.87 \times 10^6$  pfu/mL, and the diameter of the plaques was 0.4mm. The specificity test of the isolated bacteriophages of *P. aeruginosa* and *S. aureus* was tested with a bacterial group that included certifies strains of *P. aeruginosa*, *S. aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella aerogenes*, *Bacillus subtilis*, and *Salmonella diarizonae*. The presence of plaques was only found in their respective host. The morphological analysis of the isolated bacteriophages will be determined using TEM. The *P. aeruginosa* bacteriophage genetic material have been successfully extracted to further perform molecular analysis, including genome sequencing, restriction and in silico analysis. These findings confirm the presence of bacteriophages in the environment tested, allowing to test its potential used as bioprospect in phage therapy to antibiotic resistance strains of *P. aeruginosa* and *S. aureus*.

**P12****ONLINE ILLEGAL TRAFFICKING OF SPECIES IN PUERTO RICO**

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Everyday, Internet service becomes increasingly accessible, which could be both advantageous and dangerous. Illicit trafficking of species, for example, has increased due to the use of social media and free advertising pages. Illegal wildlife trafficking poses a threat to biodiversity in general. Introduced organisms can compete for resources with native and endemic species, possibly driving them to extinction. The objective of this research was to document the species currently being trafficked on Puerto Rico. During a three-month period, we used the trading site “Clasificados Online” to keep track of different species being trafficked in Puerto Rico. We recorded 155 sales posts of different species, most of which were reptiles, birds, and mammals. Out of all posts, 20% were advertised in the area of San Juan, 12.9% in Bayamón, and 11.6% in Carolina. Additionally, some species being trafficked have been found to be an invasive species in other countries, such as the hedgehog in New Zealand, and the tokay gecko in the United States, which means that these species hold the potential of becoming invasive species in Puerto Rico as well.

**P13****DISTRIBUTION AND ALLELIC FREQUENCY OF THE ENAMELIN GENE VARIANT RS7671281 ASSOCIATED TO AMELOGENESIS IMPERFECTA AND HIGH-RISK CARIES IN PUERTO RICO**

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Amelogenesis imperfecta (AI) is an inherited, rare dental disorder that affects only the formation of tooth enamel and shows both clinical and genetic heterogeneity. Similarly, the enamelin gene (ENAM) has a fundamental role in the mineralization and structural organization of enamel and any change in its sequence can affect the thickness of the enamel. The objective of this study is to be able to confirm the association between the genetic variant rs7671281 in the ENAM gene with AI and high-risk caries subjects in the Puerto Rican population. This nonsense variant has been associated with the local, autosomal dominant hypoplastic form (type IB) of AI. Through Real-time PCR, we determined the allelic frequency and geographic distribution of rs7671281 by genotyping 622 samples of healthy subjects from Puerto Rico. Due to its association with a reduction in enamel thickness, rs7671281 is also genotyped to check its role in the susceptibility to the risk of developing dental caries. The present study was carried out in the Puerto Rican population with phenotypes associated with amelogenesis imperfecta and subjects with a high to moderate prevalence of dental caries. In turn, subjects with a low to no prevalence of dental caries were considered as controls. Through the collection and analysis of saliva samples, the prevalence of the enamelin variant rs7671281 was confirmed in the Puerto Rican population. The island-wide distribution pattern is non-regionalized and influenced by coastal regions, but mostly predominated in the South and North area of the island. According to the 1000 Genomes Project, the allelic frequency of rs7671281 for the T allele was 0.885 (184) and for the C allele was 0.115 (24) based on a total of 208 samples. The present study shows a significant decrease in the allelic frequency of rs7671281 for the mutated allele C (0.0530) in comparison to the 1000 Genomes Project (0.115). Therefore, we concluded that the allelic frequencies of rs7671281 analyzed in this study are more accurate than the values given in the 1000 Genomes Project.

**P14****BIOCONTROL OF THE PATHOGEN *SALMONELLA TYPHIMURIUM* USING BACTERIOPHAGES***Pabón Maldonado, J., Quiles Pérez, C., Cafaro, M.*

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*Salmonella typhimurium* is a foodborne pathogen that causes salmonellosis in both humans and animals. An estimated 1.4 million cases of salmonellosis occur among humans in the United States each year. This pathogen is a gram-negative, rod-shaped bacterium that belongs to the Enterobacteriaceae family. The objective of this study is to find the specific bacteriophage that inhibits the bacterium that is *Salmonella typhimurium*. With this bacteriophage, we want to create a type of biocontrol to moderate its growth. The bacteriophage of this bacterium was isolated from two different methods utilizing snake feces and sewer water. With the process utilized in the methods of the research we could find the bacteriophage of the bacterium *Salmonella typhimurium*. This proved that sewer water and snake feces are a viable source of *Salmonella typhimurium* and its bacteriophages. It was evident that bacteriophages exist in every niche where bacterial organisms live. Also, that the bacteriophage found does work as a biocontrol to inhibit the growth of the bacterium.

**P15****GENETIC VARIANT (RS2304672) IN 5' UTR REGION IN PER2 GENE AND ITS ASSOCIATION TO PARASOMNIAS AND OTHER SLEEP DISORDERS IN PUERTO RICO***Pagán Gonzalez, G., and Martínez-Cruzado, J.*

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Sleeping is one of the main physiological processes of restoration. Inadequate sleep patterns can limit this process and lead to chronic health conditions. In 2014, both World Health Organization (WHO) and the Central Disease Control (CDC) in the United States indicate sleep problems as a public health crisis. Approximately 40% of the general population suffers from sleep disorders, additionally 60% of these use medications to induce sleep. External factors, such as stress, sounds, and light quality have been theorized to contribute to lack in sleep quality. Yet, little is studied on internal factors affecting sleep quality. In this study, we referenced data from the 1000 Genome Project to study the genetic variant (rs2304672) of the PER2 gene in Puerto Rico. The variant is linked to poor sleep quality and a sleep disorder known as Parasomnia. Characterized by sleep walking, sleep talking, bedwetting, nightmare disorders, and sleep paralysis principally. As an admixed population, Puerto Rico's three main ethnic groups have an influential factor in the distribution and prevalence of said genetic variant in the island. Our results found that the genetic variant is common in the southwestern and southeastern coastal regions of Puerto Rico. Additionally, we found that the genetic variant frequency in the entire island is of 3.83% in the general population of Puerto Rico.

**P16****ALLELIC FREQUENCY AND DISTRIBUTION OF M98K VARIANT ASSOCIATED WITH ADULT-ONSET OPEN ANGLE GLAUCOMA IN PUERTO RICO***Pagán Melvin, Camila A., Ramírez Aponte, Edwin G., Martínez Cruzado, Juan C.*

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Glaucoma is a severe neurodegenerative, hereditary condition that is increasingly prevailing in native Puerto Rican citizens. The purpose of this study is to correlate the M98k (rs11258194) missense variant in the Optineurin (OPTN) protein with Adult-Onset Primary Open Angle Glaucoma (POAG) in Puerto Rico; in addition, determine the distributional mutated allelic frequency throughout the Island. Optineurin is an adaptive protein that interacts in various nervous cell processes such as vesicular transportation, signaling and autophagy. By selecting 625 patient samples that span a total of 30 municipalities as a guide of the general population, we were able to genotype the samples by RT-PCR with a TaqMan Assay for SNP rs11258194. The samples were further analyzed through geographic distribution via *MapViewer*, a map-rendering tool. The results showed a total of 60 mutated alleles (48

heterozygous, 6 homozygous) mainly distributed along the coastline of Puerto Rico. Therefore, heterozygous patients with M98k variant present are more prone than wildtype patients to develop a neurodegenerative condition. Further studying will confirm if homozygous patients present POAG or other nervous-related condition such as Amyotrophic Lateral Sclerosis.

### P17

#### ORGAN PLACEMENT AS INDICATOR OF ARBOREALITY IN INVASIVE *BOA CONSTRICTOR* SPECIES IN PUERTO RICO

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Hemodynamics has been one of the main factors to study the arboreality of snake species since they have shown a direct relationship with the positioning of the heart and gravity. Topographic anatomy is used as a habitat use indicator in snakes by searching for relations between the position and morphology of internal organs and external measurements. The objective of this study was to determine the arboreality of the invasive species *Boa constrictor* in Puerto Rico by studying the positioning of the heart relative to the total body length and observe if there is a difference between the arboreality behavior between adults and sub-adults. We collected and examined data from 86 snakes from a period of three months, in which the specimens were dissected and the relative position of 5 organs to the heart was measured and TBL was calculated using SVL and Tail length. Later, statistical analysis was made to determine if there were significant differences between the two groups, including T-tests and linear regressions. It was determined that there was no significant difference between the two categories (25% -adults / 27% -subadults), which implied that there was a general arboreality for the species. Through linear regression and literature, it was determined that *B. constrictor* is a semi-arboreal species, it was also observed that sub-adults tend to be more terrestrial and adults scansorial, that is, the ability to climb trees.

### P18

#### DETECTION OF SIDEROPHORE PRODUCING BACTERIA IN PUERTO RICAN SOILS

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During the industrial revolution asbestos was a common material used in constructions due to its incredible properties. Unfortunately, long term inhalation of asbestos fibers has been linked with many lung diseases. Previous research has shown that trace amounts of iron in asbestos may be responsible for its toxicity since iron can promote reactive oxygen species to develop, which can lead to cellular damage. A possible way to treat asbestos-filled sites would be to remove the iron and to achieve this, a geomicrobiological solution using siderophores has been proposed. Siderophores are small chelating molecules produced by microorganisms capable of trapping iron in the environment. The focus of this research is to isolate and characterize siderophore-producing bacteria (SPB) from Puerto Rican soils. SPB have been identified using Blue CAS agar which turns from blue to orange in presence of siderophores. Soil samples were collected from the southwestern coastal municipality of Cabo Rojo including sample from a salt flat. To isolate SPB, serial dilutions until  $10^{-6}$  were performed to the samples and grown on CAS media for 72 hours at 37°C. Colonies with orange halos were isolated for further molecular and microbiological characterization. Determination of UFC/g showed the samples ranged from  $1.55 \times 10^{-4}$  UFC/g (where 9% SPB was identified) and  $4 \times 10^{-2}$  UFC/g (where 100% SPB was identified). Bacteria isolated from the salt flat had the most siderophore production compared to other soil samples indicated by halo size. 16S rDNA has been amplified from SPB to further perform sequencing in future works. Spectrophotometry is currently being used to quantitatively determine siderophore production by measuring the absorbance of supernatant of bacteria grown on iron-limited media with CAS reactant. This research could help develop methods of utilizing bacteria as tools to decontaminate asbestos-filled sites.



**P19**  
**ISOLATION AND DETERMINATION OF SPECIFIC LETHAL FACTOR INTERACTING PARTNERS USING HUMAN HEART T7 PHAGE DISPLAY**

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*Bacillus anthracis* is a spore forming pathogenic bacterium that causes anthrax disease that has been used as a biological weapon. The pathogenicity is due to two plasmids that it possesses, known as pXO1, which synthesizes an exotoxin, and pXO2, which synthesizes a capsule of poly- $\gamma$ -Dglutamic acid that inhibits host phagocytosis. The lethality of the tripartite toxin secreted by the bacteria, is due the component lethal factor (LF). It is known that LF is a metallo-protease capable of inactivating regulators such as mitogen activated protein kinase (MAPK), interfering with cell cycle, leading to cell death. However, it is not clear if MAPKs are the only target for LF; therefore, it is necessary to explore novel potential ligands for LF, using different strategies to further unravel new molecular pathogenesis pathways. LF has been also associated with cardiac dysfunction, suggesting human heart (HH) cells as potential targets. The purpose of this research is to isolate and identify LF specific interactions peptides using premade T7 Phage Display (T7PD) with cDNA HH libraries as ligands. The T7PD express the HH peptides on the capsid of the T7 phage to unravel the protein-protein interaction with the LF, using wild type (WT) and active-site mutant (MT) LF as targets. After several biopannings rounds, a total average of  $3.9 \times 10^6$  and  $3.4 \times 10^6$  pfu/mL for WT and MT LF respectively isolated. Individual plaques DNA were isolated, and 26 cloned HH cDNA amplified using PCR. The amplicons ranged from 100 to 700bps, of which 20% of the amplicons were sent to be sequenced to further perform *in silico* analysis to identify the fragment encoded peptide and relate it with the protein family involved in the interaction. To determine the specificity of the human heart peptides with a high affinity to LF, specificity test was performed to >25 candidates. According to the results the potential T7 phages displaying HH peptides possessed affinity to the LF and blocking agents. Specificity Tests are in progress in order to map and confirm the main target and potential regions of interaction of the MT-LF. Understanding novel LF interaction ligands in the HH, have the potential of identifying targets to develop new biomarkers and therapeutics against anthrax disease in case of a bioterrorism attack.

**P20**  
**IDENTIFICATION AND MOLECULAR ANALYSIS OF CULTIVABLE AND UNCULTIVABLE BIOPROSPECTS CAPABLE OF PRODUCING BIOFILM**

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Microbial biofilm formation can provide structural and functional advantages to the microbial community including tolerance to drastic changes in pH, temperature and presence of antimicrobial agents. Nowadays biofilm studies have taken focus in understanding its role in bioremediation, industries contamination and biomedical research, specifically in nosocomial infections due to antibiotic resistance. Nosocomial infections are the *fourth leading cause of death in the U.S.* with 2 million cases annually and the cost of the treatment related with this event has an average of \$2,100 per case. Also, biofilm has shown impact in the medical devices industry and its application in bioremediation, specifically in the field of wastewater in which have been used in biodegradation, bioaccumulation, biosorption and biomineralization in municipal water treatments. This research seek to determine the ability of Purple Non-sulfur Bacteria (PNSB) from Macro and Micro environments in Puerto Rico, and clones from Metagenomics libraries to produce biofilms. The Microtiter Dish Biofilm Formation (BF) Assay was used to detect the BF in the isolates, and the presence of known BF genes was determined by PCR. A total of 4 PNSB isolated from bromeliad phytotelmata were positive for BF assay. The culture dependent genetic analysis suggests that some of the genes responsible for BF are similar to *icaA* from *Staphylococcus aureus*. This result support the importance of searching for BF activities in novel environments combining culture dependent and independent approaches to understand and identify novel genes associated with biofilm formation with potential biomedical and biotechnological applications.

**P21****DIET CHARACTERIZATION OF THE INVASIVE *BOA CONSTRICTOR* IN PUERTO RICO**

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The *Boa Constrictor* (*Boa Constrictor*) is an invasive species that comes from other places to Puerto Rico. This causing a negative impact on the biodiversity as well as the inhabitants of Puerto Rico. *B. Constrictor* is a widely distributed, large-bodied generalist, feeding on diverse types of prey items including mammals, birds and reptiles (Bakkegard, K., Timm, R. , 2001). It has been noted that a relationship exists between prey items and predatory size. The purpose of this research is to examine diet patterns of adults and sub-adults of the species as well as understand the variations in prey items. All snakes used in this research were provided by the Department of Natural and Environmental Resources of Puerto Rico and were euthanized. Each snake was subjected to necropsy in order to collect data for the size and identification of what was eaten. A total of 845 snakes were examined. In concluding the recollection of data, it was determined that the most prominent species found in the intestines was *Rattus norvegicus* or *Mus musculus* (48.7% subadults & 48.0% adults). The second most prominent species being unknown bird prey items (10.2 % subadults y 8.3 % adults). It was found that while subadults feed on smaller prey such as *Rattus norvegicus* or *Mus musculus*, adults feed on larger prey such as *Iguana iguana*.

**P22****EXAMINING SEXUAL DIMORPHISM OF THE INVASIVE *BOA CONSTRICTOR* IN PUERTO RICO**

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The *Boa constrictor* exhibits a female-biased sexual size dimorphism in which the females have longer body lengths and are usually heavier than the males of the species. Descriptions of the *Boa constrictor* on islands have revealed a tendency for dwarfism when in comparison to the snakes that are observed on the mainland. Our objective is to determine if sexual dimorphism is changing in this invasive species on the Island. Boas were collected from different locations from 2011 to 2014, 2018 to 2020, and early 2021. Sexual size dimorphism (SSD) index was calculated. A total 636 females and 572 males adult snakes were processed during the study period. For the years 2011-2014 the SSD was 0.0519, 0.1561, 0.1446, 0.1388 respectively, whereas for the years 2018-2021 the SSD was 0.2156, 0.2407, 0.1925 and 0.1720 respectively. Statistical analysis exhibited a significant difference between sexes and their head lengths, tail lengths and stoutness, but showed no significant difference for the mass. Female snakes continue to be larger than males, therefore, dimorphism is still present on the island. We can conclude that in Puerto Rico, the conditions are still favorable for this species. Factors that may contribute to the increase in size may be due to a good source of food and energy, combined with a sustainable habitat.

**P23****MARKET EVALUATION AND COMMERCIALIZATION OPPORTUNITIES FOR CELL MANUFACTURING INNOVATIONS IN PUERTO RICO AND THE UNITED STATES**

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As a part of the *National Science Foundation* (NSF), the *Cell Manufacturing Technologies* (CMaT) Innovation Ecosystem Research Group at UPRM focuses on innovation and entrepreneurship within the cell manufacturing therapy sector so as to make these treatments more accessible and scalable for clinical and industrial uses. In this study, an exploratory research was performed via a PESTEL (political, economic, social, technological,

environmental, legal) analysis to identify opportunities and limitations that exist in Puerto Rico and the United States for the development of small and medium enterprises in the cell manufacturing industry. Interviews were also conducted to important stakeholders within the pharmaceutical and biopharmaceutical industry to evaluate the actual status of these industries in Puerto Rico. In regard to Puerto Rico, the pharmaceutical industry was identified as a promising sector for the development of CMA<sub>T</sub> given this industry has been operating in the island for more than 60 years— representing one third of its gross domestic product. The island is positioned as the largest export of biopharmaceuticals in the United States since 8 of the 15 most sold biopharmaceuticals are produced in the island. Additionally, Act 60-2019 establishes the new Puerto Rico Incentives Code which presents tax exemptions that could be considered as attractive for companies to establish operations in the island. In like manner, Invest PR is a company that dedicates itself to presenting Puerto Rico as a competitive inversion to attract foreign companies to the island. Some limitations identified within the island involved the high cost of manufacturing and utilities. The political status and the deteriorated infrastructure of essential services such as the electric power sector were also recognized as weaknesses of the pharmaceutical industry in Puerto Rico. This market analysis' results can be used as a tool to facilitate the development of new companies in Puerto Rico's pharmaceutical industry since it is considered essential for the island's economy.

#### P24

### DETECTING OPIOIDS HIDDEN INSIDE MAIL FLATS USING PORTABLE RAMAN SPECTROMETERS AND CHEMOMETRICS

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Deaths by opioid overdose have persists as one of the great problems in our country. The U.S. Customs and Border Protection (CBP) agency currently needs better technology for detecting opioids on IMFs. Our work is focused on detecting an opioid simulant inside four different types of mail flats using portable Raman spectroscopy. The developed SIMCA model was able to classify 94% of the test samples correctly.

#### P25

### DRUGS UPTAKE BY LEUCAENA LEUCOCEPHALA IN AN ELECTROCHEMICAL ANALYSIS

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A study was conducted to determine the potential to uptake of four different medications by *Leucaena Leucocephala*: Duloxetine, Acetaminophen, Gabapentin, and Naproxen. Procedures for treating the seeds were carried out and kept them in a controlled environment of growing up, then they were transferred to a hydroponic system with the necessary nutrients, UV light and oxygenation to improve their growth. For each drug, an electrochemical calibration curve was constructed that allows measure and comparing the concentration of each observation during experimentation. A determined amount of medicine was placed in each hydroponic planting and the variation of its concentration over time was measured. Finally, the decrease in the concentration of the drugs was determined on the third day, however, there were increases in the concentration of said drugs in all the samples on the fifth day; In this way, it is concluded that there are factors that influence the measurement results of the electric current in the process, requiring the refining of the method to establish coherent and statistically significant results.

**P26****ZINC SULFUR-BASED QUANTUM DOTS: SYNTHESIS AND CHARACTERIZATION BY HRTEM**

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Nanostructures are materials characterized by their nanoscale size and dimensions between 1 to 100 nm. These materials have distinct properties such as optical, magnetic, and electrical which define their application in technology, industry, and medicine. Moreover, nanostructures are found in daily or household products including cosmetics, clothing, electronic devices, and even in medical procedures. Due to their broad applications, researchers are focused to synthesize these nanostructures in a cost effective and environment friendly manner. Zinc-based nanomaterials have been used in diagnosis of plant diseases, photocatalytic degradation of pharmaceuticals, and dye waste removal. This research is focused on the synthesis and characterization of ZnS quantum dots using High-Resolution Transmission Electron Spectroscopy which allows to nanoparticles characterization. The main research goals of this project are: 1) to synthesize ZnS quantum dots of different nanometric sizes, 2) to stabilize quantum dots in water with thioglycolic acid, and 3) to characterize quantum dots using High-Resolution Transmission Electron Microscopy, Electron Dispersion X-ray analysis, Fluorescence Spectroscopy, Absorbance Spectroscopy, and Infrared.

**P27****STIMULATION OF ZnS AND Mn-DOPED ZnS QUANTUM DOTS ON GERMINATION****PERCENTAGE OF *Lactuca sativa***

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Nanoparticles have the potential to be used in broad applications nowadays. Improving plant production safely is of great importance because of population growth and climate change; semiconductor quantum dots may be able to achieve this successfully for the producers, environment, and consumers. Quantum dots might be used in plants as nanofertilizers. They are seen as an alternate route from contaminating fertilizers. Nanoparticles are, likewise, able to expand crop production and biomass in plants. Nonetheless, in large amounts, these can be harmful and toxic. *Lactuca sativa*, a horticulture consumed globally, will be exposed to pure ZnS and Mn-doped quantum dots synthesized with a reflux system. Our work's objectives are the following: 1) Compare the percentage of germination in *Lactuca sativa* between ZnS and Mn-doped ZnS stabilized; and 2) Evaluate the growth of hypocotyl and radicle of *Lactuca sativa* in the concentration of 0 ppm and 250 ppm.

**P28****HIGH EXPLOSIVES DETECTION IN INTERNATIONAL MAIL USING SEE-THROUGH RAMAN SPECTROSCOPY ASSISTED BY MULTIVARIATE ANALYSIS**

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See-Through Raman Spectroscopy (STRS) was used for the non-invasive, non-destructive sample analysis of high explosives (HEs) in mail envelopes or flats. The method resulted in a safe and rapid analysis of HEs: ammonium nitrate (AN), urea nitrate (UN), and pentaerythritol tetranitrate (PETN). The analysis was carried on under normal conditions without sample preparation to simulate a scenario similar to the ones found at an International Mail

Facility (IMF). The ST-RS system operates under high photon scattering conditions enables a deeper penetration by the incident laser beam. It is a portable, rapid, high throughput technology that enables the characterization of chemical and biological threats (CBTs) by exciting their vibrational modes. Multivariate analysis (MVA) was applied due to the vast amount of data generated in the experiments, and the spectral interferences presented by the envelopes (flats). Under these conditions, it was complicated to obtain robust results in a short time. Exploratory Data Analysis (EDA) was applied to separate HEs signals from mail flats spectral data. Principal Component Analysis (PCA) was capable of classifying each variable, explaining most of the experimental variance using the first two principal components: PC-1 and PC-2. The PCA-based models were efficient in classifying HEs' vibrational markers even when contained within several flats layers and classifying HEs into different clusters. PC loadings were used to determine each variable's contribution to the PCA models, which resulted in correlation coefficients ( $R^2$  values) of 0.99 and 0.92 for the first PC for UN and PETN, respectively.

### P29

#### BIO-THREATS DETECTION IN INTERNATIONAL MAIL USING RAMAN SPECTROSCOPY

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Bacteria, viruses, and toxins are the main groups considered as biological threats (BTs). Unlike chemical hazards, BTs detection tends to be more complicated due to organisms having less than 5  $\mu\text{m}$  in diameter, leading to delays in identification. The evidence produced by these BTs can delay identifying targets for hours, days, and even weeks until a pattern can be recognized. This slow process in acquiring the required evidence for identification/detection makes BTs a high risk to national security. They are relatively invisible and from various settings where they can directly be used for terrorism. Since powdered anthrax spores were deliberately put into letters and mailed through the US postal system in 2001, investigations on BTs have taken great importance to prevent events that could result in sicknesses and, the worst scenarios, even deaths. Our research is based on detecting the biological simulant *Bacillus thuringiensis* (*Bt*) as a simulant for *Bacillus anthracis* (anthrax) due to their genetic resemblance. The project's success should lead to non-destructive analysis and reduce the risks of anthrax attacks. *Bt* is also an aerobe that can produce endospores and has morphological and biochemical similarities to anthrax. The endospores are responsible for many human diseases, and they will be the main components to analyze, having a much smaller diameter than other microorganisms. These endospores can sporulate in adverse conditions. According to Clinical Infectious Diseases, the mortality rate of inhaling anthrax is high, but it can vary. Raman Scattering spectroscopic technique will allow detecting this biological simulant on different surfaces to elucidate their vibrational behavior with the possibility of implantation for analysis by First Responders on mail packages. Large sample size from the acquired Raman spectra will be used to provide a robust multivariate analysis model for further use in national security purposes.

### P30

#### ELECTROCHEMICAL ANALYSIS OF THE BIORREMEDICATION OF PHARMACEUTICAL DRUGS

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Abuse of pharmaceutical drugs has led to wastewater contamination due to their presence in human feces. These waters eventually get to sources of potable water and may present a hazard to humans. In addition, pharmaceutical companies must constantly regulate their disposal of drugs wastes to minimize pollution. These companies use methods of detection of contaminants such as High-Performance Liquid Chromatography, Gas Chromatography, etc. This research is aimed to develop a new detection limit (LOD) method for pharmaceutical drugs using Cyclic

Voltammetry (CV), an Electroanalytical technique that use a Glassy Carbon (GC) as a working electrode. CV is a more economically viable method of lower detection limits than previously mentioned methods. During this study, various drug sample solutions, such as Clonazepam and a combination medication of Acetaminophen, Pamabron and Pyrilamine, were prepared in a 0.1M potassium chloride (KCl) solution used as the solvent. Solutions with a range of concentrations from  $10^{-2}$  to  $10^{-6}$  were prepared for each drug and the variation in the anodic or cathodic peaks was observed. Afterwards, a calibration curve of current vs. concentration was prepared for each drug. Preliminary results show that reduction or oxidation signals may be obtained even at parts per million concentrations.

### P31

#### ANTIPROLIFERATIVE PROPERTIES OF ETHANOLIC AND AQUEOUS GRAVIOLA LEAF EXTRACTS ON TONGUE SQUAMOUS CELL CARCINOMA CELL LINE-25 (SCC-25)

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*Annona muricata*, commonly known as Graviola, soursop, or guanabana, is an evergreen tree native to the tropics with a long history of use in ethnomedicine in indigenous communities in Africa and South America. Its active phytoconstituents have provided medicinal benefits against various ailments and diseases such as arthritis, parasitic infection, hypertension, fever, or diabetes. Studies conducted in vitro and in vivo have concluded that Graviola phytoconstituents have anti-cancer and anti-tumor properties. One of the characteristics of cancer cells is their uncontrolled proliferation rate. In that sense, molecules that inhibit cell proliferation offer potential therapeutical benefits. While Graviola has been reported to be toxic to cell lines models for breast, colorectal, skin, head and neck, lung, liver, pancreatic, and prostate cancer, its effect on models of head and neck cancers has not been fully investigated. To fill this knowledge gap, we have assessed the antiproliferative/cytotoxic properties of Graviola on Squamous Cell carcinoma cell line 25 (SCC-25), an in vitro model for head and neck cancers. The results of our study are reported here. We botanically identified a local Graviola specimen, located in Boquerón, Cabo Rojo, PR, which leaves we collected and dried. We subsequently prepared ethanolic (EE) and aqueous leaf extracts (AE) and tested their respective antiproliferative activities on SCC-25 cells. The cells were treated with increasing amounts of EE or EA for 24h (dose-response analysis) and the respective doses leading to a 50% inhibition of cell growth (GI50) determined. The lower the GI50, the cytotoxic active the extract. Our results show that EE is 4 times more active in inhibiting the growth of SCC-25 than AA (respective GI50 of 61.7  $\mu\text{g/mL}$ , and 274.6  $\mu\text{g/mL}$ ). We hypothesize that some organic compounds responsible for the antiproliferative/cytotoxicity of the Graviola leaves were selectively extracted by Ethanol. Plans include the chemical characterization of those bioactive compounds. To assess whether EE could qualify as a potential anticancer drug with little to no toxicity to normal/non-cancer cells, we will also conduct comparative dose-response analyses on SCC cell lines vs. non-cancerous oral cells. By doing so, we hope to discover natural molecules to be used as alternative treatments for Oral Squamous Cell Carcinomas.

### P32

#### USER CHARACTERISTICS, SPATIOTEMPORAL PATTERNS, AND SPATIAL ACCESS IN A DOCKLESS E-SCOOTER SERVICE IN PUERTO RICO

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A case study is presented of a dockless e-scooter system in Mayagüez, Puerto Rico. As part of the analysis, the attributes and opinions of users and nonusers of the e-scooter service are examined. In addition, methods are proposed for quantifying spatial access to dockless micromobility systems and for measuring the regularity of

their spatiotemporal patterns. Spatial access is measured in terms of network-level proximity to the e-scooter fleet, and the regularity of spatiotemporal patterns is assessed using a similarity measure approach.

The analysis suggests that, like in other cities, e-scooter users tend to be male and young, and that nonusers do not participate in the system given cost and safety concerns. Most users are students at the University of Puerto Rico at Mayagüez (UPRM). Trips starting or ending at UPRM account for 78% of all e-scooter trips, which are also closely linked to neighborhoods with a high concentration of UPRM students. The majority of e-scooter trips occur during weekdays, and the demand for the service drops significantly when the university is not in session. Lastly, the application of the proposed methods is illustrated using data from the considered system. Differences in spatial access within and between the study zones are observed.

### P33

#### **CHARACTERIZATION OF CULTIVABLE BIOPROSPECTS OF THE RICE FIELD OF THE AGRICULTURAL EXPERIMENT STATION OF LAJAS**

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The brewing industry is in constant dependence of microbial enzymes capable of degrading raw material. Currently, the emergence of new craft beers made from various grains, such as rice, has increased the search for new enzymes capable of converting starch to fermentable carbohydrates. The objective of this research is to find cultivable bioprospects capable of degrading starch from rice fields at the Lajas Agricultural Experiment Station (LAES). The isolation of the cultivable bioprospects was carried out by an analysis of the fluctuations in temperature of the LAES rice field and using three culture media: a differential culture medium, a minimal culture medium supplemented with starch and a natural culture medium supplemented with starch. The predominant temperatures in the soil were 25°C and 30°C which were used for the isolation of cultivable bioprospects. A total of 320 cultivable bioprospects capable of degrading starch were isolated. It was observed that 32% of the microbial flora isolated at 25°C had the ability to degrade starch, while 45% of the microbial flora isolated at 30°C had the ability to degrade starch. The predominant morphology among the 320 cultivable bioprospects was spore-forming bacilli. On the other hand, the ability to degrade starch among bioprospects was variable due to the fact that strong to weak degraders were observed. The discovery of new amylases capable of degrading various sources of starch, such as rice, could allow the development of new products at an industrial level.

### P34

#### **TRAINING OF A NEURAL NETWORK THROUGH ITERATIVE OPTIMIZATION**

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Training a neural network implies finding its parameters to provide the best approximation quality to known patterns, while still being able to predict reliably when faced with unknown patterns. In other words, a neural network must have a balance between its capabilities to learn and to generalize. With such a problem this research group proposes applying a bicriteria iterative optimization strategy to manipulate the parameters of a simulation model to arrive at the best possible configurations in the presence of several performance measures in conflict and find the parameters in search of such balance.

*Keywords:* Data Simulation, Neural Network, Iterative method, Optimization, Prediction

**P35****NAVIGATING EXIT ROUTES USING AUGMENTED REALITY**

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The utilization of Augmented Reality (AR) is a great way to make complex routes and buildings easy to navigate. With the widespread availability of high-resolution phone cameras, we can implement AR seamlessly into everyday life. Using QR codes we can place these three-dimensional AR objects on a two-dimensional plane and have people scan them. Simple arrows are projected in the direction we would advise the person to walk towards in case of an emergency. This method provides a simple solution to complex escape routes as the only necessary equipment for a person to follow would be their cell phone camera and the 3DQR app that is available for free on the app store.

This project consists of creating viable escape routes in complex buildings that would be easy to follow in case of an emergency. We do this by placing individual QR codes in places such as hall intersections where people could easily make a wrong turn. These QR codes are scannable through an app that would quickly place a three-dimensional arrow in front of the code telling the person where they need to go. This method is excellent for our project due to low production costs and it circumvents one of the biggest problems of emergency navigation which would be overloaded servers. Taking the positioning aspect of the navigation and placing it in the real world allows for everyone to access at the same time without having to worry about servers crashing or being unresponsive in a situation where time is crucial.

**P36****OPTIMIZATION ANALYSIS OF TWO GROUPS**

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The standard method to decide if a group of data is comparatively different than other in terms of location, dispersion, and proportion is the statistical comparison. This work attempts to look into this problem with a mathematical optimization perspective. Optimization is necessary because comparing statistical analyses seeks to improve the process by helping to determine whether two groups are different or not. Each case generates a normal random data with the parameters required for them. P-Value, which we compare with alpha, is the probability of having the measured difference of a group randomly.



**P37****ASSESSMENT OF SURFACE ROUGHNESS EFFECTS ON ENCAPSULATED PHASE CHANGE MATERIALS FOR HEAT TRANSFER ENHANCEMENT***Torres-González D. and Torres-Nieves S.*

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The understanding of encapsulated phase-change materials (PCM) used for thermal energy storage or as a thermal management tool is crucial in the development of more efficient systems with applications in the renewable energy and aerospace fields, among others. The heat transfer mechanisms that encompass PCMs strongly depends on the shape of the container that encloses the PCM. However, there is a lack of fundamental understanding in the literature on the effect of different shape capsules with surface roughness on the heat transfer process of encapsulated PCM. This study seeks to improve the thermal performance of encapsulated PCM by finding the optimal geometry and surface treatment for heat transfer and heat storage capacity. Numerical simulations are being performed to assess the effects of geometry on the heat transfer rate and other phenomenon. A three-dimensional computational fluid dynamics (CFD) model is being developed to study PCM encapsulated in various geometries in a tank containing a heat transfer fluid (e.g., water). The maximum thermal stored energy and maximum system temperature are also evaluated. Preliminary results for an axisymmetrical 2D representation of a very thin cylinder show that time required for complete melting is 58s for  $L=D = 100$  and the total energy stored after that time was 2.4 kJ. The future agenda for this work include three geometries (1) cylinder (2) square, and (3) sphere with the same system volume and PCM material without and with (uniform/non-uniform) surface treatment for a total of nine case studies. Numerical results will be analyzed and compared with experimental data.