Scientific Caribbean Foundation

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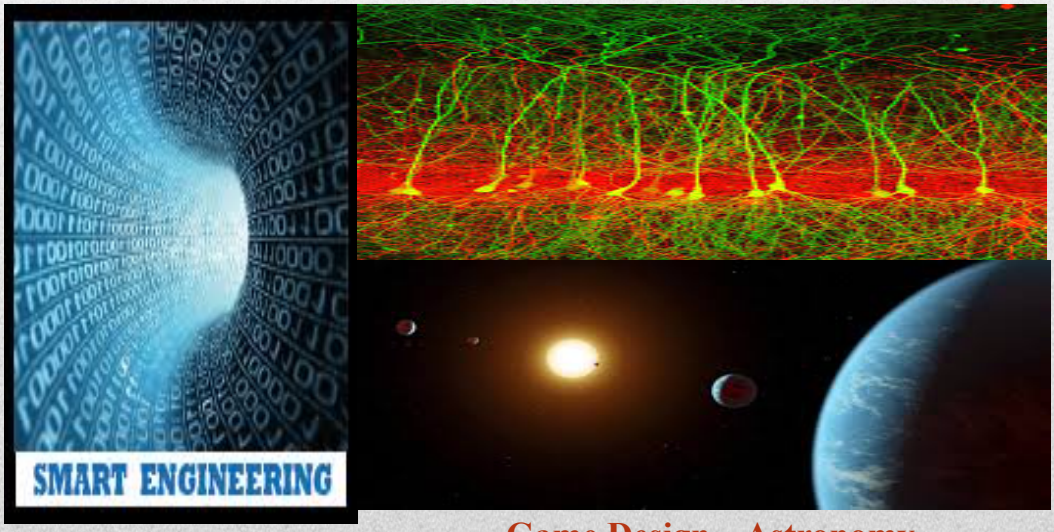
Student Research Development Center

Winter 2019

Pre-College Research Symposium

Genomics - Biology - Neurosciences



Game Design – Astronomy

Saturday, December 7, 2019

Universidad Ana G. Méndez, Recinto de Gurabo

Ignacio Morales Nieva Theater

Gurabo, Puerto Rico

SCIENTIFIC CARIBBEAN FOUNDATION
AND THE
STUDENT RESEARCH DEVELOPMENT CENTER

ARE PROUD TO HOST THE

WINTER 2019 PRE-COLLEGE RESEARCH SYMPOSIUM

SHOWCASING MINORITY HIGH SCHOOL STUDENTS' MENTORED RESEARCH

Leadership at

SCIENTIFIC CARIBBEAN FOUNDATION

Juan F. Arratia, Ph. D.
President and Founder
Research Professor and Mentor

SAN JUAN, PUERTO RICO

December 7, 2019

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Scientific Caribbean Foundation
Student Research Development Center

MISSION

Scientific Caribbean Foundation (SCF) was founded by Dr. Juan F. Arratias, a 2006 US Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring recipient, with the idea to continue the success of the Model Institutions for Excellence (MIE), a grant awarded by the National Science Foundation (NSF) to transform Universidad Metropolitana (UMET) into a nationally recognized undergraduate research institution, and a model in science, technology, engineering and mathematics (STEM). Mentoring of undergraduates and pre-college students by research mentors was the cornerstone of the MIE Project. Dr. Arratia was the Principal Investigstor of the MIE grant at UMET. We believe that creative research is one of the best ways to prepare students to become persistent and successful in college, graduate school and professional careers. Today, the Student Research Development Center (SRDC), which is part of the SCF, is the entity that will continues the MIE strategy by impacting pre-college and university students from institutions in Puerto Rico and across the nation, as well as pre-college students from the Puerto Rico Educational System.

EXECUTIVE SUMMARY

The MIE ended in 2009 at UMET. The outcome of the program was over 280 UMET STEM-C majors completed their BS degrees and 175 were transfered to graduate school, with 65 achieving doctoral status (PhD, MD, VVM, Pharm D). In order to increase the number of BS degrees transferred to graduate school, we will continue with the strategy of an early research program and partnership with key research institutions in Puerto Rico, the US mainland and abroad. Research mentoring will be the central component of the knowledge transfer and creative thinking activities at SCF. Project based learning, collaborative learning strategies, presentations at scientific conferences, scientific writing and co-authorship, technology literacy, and preparation for graduate school are activities that are transforming the philosophy of competive institutions.

GOALS

The main goal of the Winter 2019 Pre-College Research Symposium is to encourage pre-college research with research mentors, develop students' written and oral communication skills, provide a forum in the Caribbean for students to foster interest in undergraduate education, particularly STEM-C fields and set national research standards for pre-college research presentations.

SCIENTIFIC CARIBBEAN FOUNDATION
STUDENT RESEARCH DEVELOPMENT CENTER

SPRING 2019 PRE-COLLEGE RESEARCH SYMPOSIUM

CONFERENCE AT A GLANCE

SATURDAY, DECEMBER 7, 2019.	ANA G. MENDEZ UNIVERSITY, GURABO, CAMPUS IGNACIO MORALES NIEVA THEATER

8:00-9:00 a.m.	**Registration**	**Theater**
8:15–8:40 a.m.	**Judges Meeting**	**Theater**
8:40-9:00 a.m.	**Opening Ceremony** **Dr. Juan F. Arratia** **Research Professor and Mentor** **Javiola D. Pagan Torres, Kynote Speaker**	**Theater**
9:00–11:25 a.m.	**Poster-Oral Session**	**Theater**
	Neurosciences-Biological Sciences **Atmospheric Science and Engineering** **Game Design and Developemnt** **Marine Science-Astrobiology and Genomics** **Environmental Neurobiology**	
11:25-11:40 a.m.	**Pre-College Alumni Research Experiences**	**Theater**
11:40–12:00 p.m.	**Awards Ceremony and Closing Remarks**	**Theater**
12:00 m.	**Symposium Adjourns**	

Scientific Caribbean Foundation

December 7 , 2019

Dear Pre-College Students:

The Winter 2019 Pre-College Research Symposium is the culmination of the activities and dissemination process of the Fall 2019 Saturday Research Academy Program of the Scientific Caribbean Foundation. For a period of four months, since August 31, 2019, all of you, over thirty pre-college students from private and public high schools of Puerto Rico worked long hours in the research laboratories of Polytechnic University of Puerto Rico, and Universidad Ana G. Mendez-Gurabo Campus, with the guidance and mentorship of faculty and student research mentors in research projects in STEM–C fields.

One of the objectives of the Winter 2019 Pre-College Research Symposium is to offer young motivated high school researchers the opportunity to learn and to practice their English communication skills in a formal professional scientific meeting. A second objective is to give high school students of Puerto Rico a forum for the presentation of the outcomes and findings of their research projects to research mentors, family members, and the educational community at large.

We at Scientific Caribbean Foundation are proud of the results obtained by the pre-college students and their mentors in the Fall 2019 Saturday Research Academy Program. I hope your experience inspires you and your peers to select science, technology, engineering, mathematics and computer science (STEM-C), as your field of study in the near future.

My sincere appreciation goes to the staff of the Student Research Development Center and the student research mentors, and Pre-College Research Alumni for their effort and commitment to implement the Winter 2019 Pre-College Research Symposium.

Sincerely yours,

Juan F. Arratia, Ph. D.
Founder and President
Research Professor and Mentor
Scientific Caribbean Foundation

KEYNOTE SPEAKER

Keynote Speaker's Biosketch

Fabiola D. Pagán Torres, BS Student at University of Puerto Rico, Alumni and Research Mentor of Pre-College Research Program

D. Pagán Torres is currently Fabiola an undergrad in the University of Puerto Rico Bayamón Campus, pursuing a bachelor's degree in Biology. She works as a teacher assistant in DoD STARBASE by the Puerto Rico NASA Grant Consortium, which focuses on elementary students. The goal of the program is to motivate the students to explore Science, Technology, Engineering and Math (STEM) as they continue their education. She has passed through enrichment opportunities in different areas of science. During her senior year of high school, she started to get involved in research. It began in the program of the Pre-College Saturday Academy of the Ana G. Méndez System sponsored by the National Science Foundation. She was able to complete two scientific investigations. After that, she had the opportunity to attend in an internship at the University of Vermont, where she worked with Dr. Vigouroux. Over time, the opportunity of mentoring was given in the Saturday Research Academy. She applied the skills learned from her past mentors. From that time on, she has served as a research mentor for 26 students. She again received the opportunity to participate in the SNURF Program under the guidance of Dr. Ballif in the University of Vermont. The research focused on studying the protein called TLT-1 more thoroughly. During this process, she acquired skills that are essential in biology. From learning how to culture cells, do immunoprecipitation, SDS-Gels and Western Blots. After this experience she started getting more involved in doing volunteer work and also manage to shadow an ophthalmologist, Dr. Carlos del Valle Biascochea. Her long-time goal is to acquire an MD/PhD.

RESEARCH MENTORS

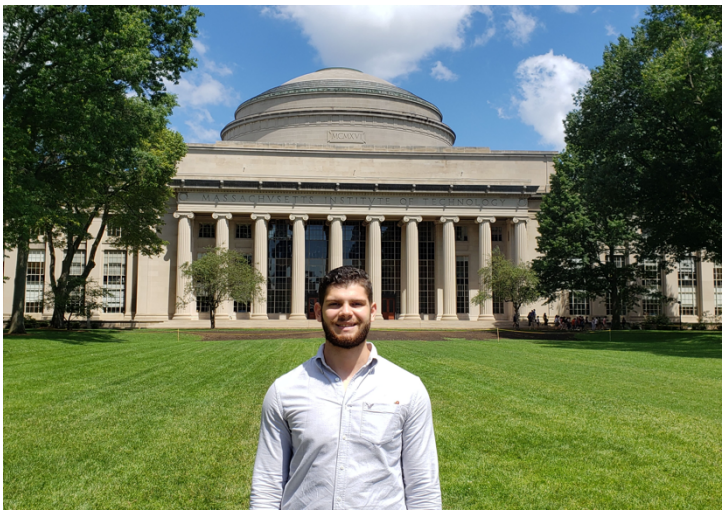
Juan F. Arratia, PhD
Research Professor and Mentor
Scientific Caribbean Foundation

Dr. Juan F. Arratia was born in Pomaire, Chile. He graduated from Universidad Técnica del Estado with a BS in Electrical Engineering in 1973. He was awarded a MSc in Engineering from Louisiana Tech University, Ruston, Louisiana, in 1979 and a Ph.D. in Electrical Engineering from Washington University, St. Louis, Missouri in 1985. He has taught and conducted research at universities in Chile (Universidad Técnica del Estado and Universidad Austral de Chile), Puerto Rico (Universidad Interamericana de Puerto Rico and the University of Puerto Rico-Mayaguez), and in the US mainland at Washington University, St. Louis, and Louisiana Tech University, Ruston, Louisiana. He has lectured and given conferences on advanced automation, robotics, vision systems, artificial intelligence, total quality management and science and engineering education in Chile, Bolivia, Ecuador, Guatemala, Panama, Mexico, Brazil, Nicaragua, Perú, Canada, Spain, the Netherlands, Turkey, Japan, Philippines, Singapore, Australia, China, Puerto Rico and in the US mainland. He was the Advanced Manufacturing Manager for Medtronic, Inc., a leading pacemaker company, and is a consultant in advanced automation for pharmaceutical and medical devices companies in Puerto Rico. From 1998 to 2008, he was the Director and Principal Investigator of the Model Institutions for Excellence (MIE) Project, a National Science Foundation sponsored program based at Universidad Metropolitana in San Juan, Puerto Rico. From 2008 to 2018, he was the Executive Director of the Ana G. Méndez University System (AGMUS) Student Research Development Center, designed to disseminate MIE best practices at Universidad del Turabo and Universidad del Este. For twenty year he was part of AGMUS and during his tenure he wrote proposal to NSF and was awarded more than 85 million USD for MIE, CCCE, AGMUS Institute of Mathematics, MRI-AMISR, MRI-Puerto Rico Laser, Administration of Arecibo Observatory among others. Since 2018 to present he is the President of Scientific Caribbean Foundation in San Juan Puerto Rico. In November 2007, he was awarded the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring at a ceremony in the White House in Washington DC.

Ruben A. Garcia, Research Mentor and Alumni of Pre-College Research Program

Rubén A. García is currently an undergraduate student in his senior year pursuing studies in Psychology with a minor in Cognitive Sciences at Ana G. Méndez University, Cupey. Before deciding whether to pursue a degree in a STEM+ field, he participated in the Saturday Research Program sponsored by the SRDC and the National Science Foundation for two and half years in high school. Furthermore, he has received training and has conducted projects in Chemical Engineering, Bio-Mathematics, Biology, Neuroscience, Bioinformatics, Developmental Neurobiology, Organometallic Chemistry, Ecology, and Environmental Science. All of these experiences have been gained through his involvement as a pre-college and undergraduate student at Polytechnic University, UMET and through five internships now in U.S. mainland research-intensive institutions like The University of Vermont, Washington University School of Medicine in St. Louis and Argonne National Laboratory. Furthermore, for the last year and a half, he has been an NIH BP-ENDURE Fellow conducting research in nervous system development and regeneration at the University of Puerto Rico, Río Piedras Campus under the mentorship of Dr. José E. García-Arrarás, Ph.D. Thanks to his NIH fellowship, Rubén has presented his research work at national conferences such as SACNAS and the Society for Neuroscience (SfN) gaining national exposure for two years now. Consequently, since he started his undergraduate degree in 2015, Rubén has directed the Saturday's Academy Neuroscience Research Program achieving great success with his students earning multiple awards and competing in symposiums as Intel's ISEF and the Metropolitan Science Fair. He has mentored over 70 students and the overwhelming majority (99%) of them have continued towards STEM fields at universities all around the United States (Columbia, Dartmouth, Johns Hopkins, Arizona State, Yale, Brown, Clark, Stanford and MIT) including Puerto Rico (UPR Mayagüez, UPR Río Piedras, Turabo, Inter Bayamón, Inter Metro and UMET Cupey). After he graduates, he will pursue a Ph.D. in Neuroscience specializing in translational neuroscience and bioinformatics to produce work that can help advance treatments and therapies in people with psychiatric and psychological illnesses. In January 2019, Rubén seeks to empower even more pre-college students to pursue research careers returning as a Research Mentor in the new area of Translational Neuroscience and Bioinformatics.

Melvin J. Núñez Santiago, BS Senior in Electrical Engineering at School of Engineering at Universidad An G. Mendez-Gurabo



Melvin J. Núñez Santiago is an undergraduate senior student majoring in Electrical Engineering. Previously, he graduated and obtained an Associate Degree in Electrical Technology & Renewable Energy as a Summa Cum Laude at Ana G. Méndez University (2016) and got licensed as a Journeyman Electrician by The Examining Board of Electricians of Puerto Rico awarding him the Darjo Foundation Scholarship two times. Continuing at the bachelor's degree he has participated in a variety of research internships. He worked in the Consortium for Integrated Energy Systems in Engineering & Science Education (CIESESE) summer research internship under the mentorship of Dr. Amaury Malave to develop hurricane resistance blades for the Punta Lima Wind Farm, Naguabo titled "Optimization of Hurricane Resistance Wind Turbine Blades" which was published by the Latin American and Caribbean Consortium of Engineering Institutions in 2019. Following, he participated at the CISESE year-long research internship working under Prof. Diego Aponte Roa in "Study and Modeling of DC Grids for Future Smart Homes" where he developed tests and implementation of small-scale hybrid-grids and powerline communication through DC powerlines. Throughout his undergraduate journey, he developed research with again fellow Prof. Diego Aponte Roa in the development of an electric brake system for micro-wind turbines titled "Control System Design for a 400W Micro-Wind Turbine" which was published by the Institute of Electrical and Electronics Engineers (IEEE) in 2019. He participated in the Department of Energy Collegiate Wind Competition held at the National Renewable Energy Laboratory at Boulder, Colorado in May 2019 where he and his teammates developed a small-scale wind turbine for the competition. In summer 2019 he got accepted at the Massachusetts Institute of Technology Materials Science & Engineering Research Internship where he worked under the mentorship of Dr. Anuradha Agarwal in the photonics area titled "Germanium Technology for the Mid-Long Wave Infrared". At this time, he was also a participant at the AIM Academy Integrated Photonics where he and a small team develop theoretical research in "Microwave Signal Processing". He has been able to showcase his work through a variety of international conferences and symposiums. Melvin is currently applying to continue his studies in a Ph.D. as he wants to help develop and research in areas of renewable sources, power systems, photonics and IoT.

Bryuan A. Rodriguez Lopez, Research Mentor and Alumni of Pre-College Research Program

Bryan A. Rodríguez López is a freshman college alumnus from the Polytechnic University of San Juan, P.R. whose interests are focused to make his way up the top as an Aerospace Engineer. His academic background expansion started 4 years ago when he was granted the opportunity for a college internship in Haverford Pennsylvania as a Chemistry and Engineering Sophomore. Throughout the years he has performed in different internship programs in fields such as astronomy, Epidemiology and Mechanical Engineering. In senior high school, he had excelled in various engineering clubs and programs, including the SHPE Jr. Program (Society of Hispanic Professional Engineers) in which he had become the President for 2 exciting years. Parallel to his academic background, he has also devoted himself for the participation of the Saturday Research Program for 4 consecutive years, finally granting him a spot as a research mentor recently this year. Nevertheless, to say, in 2016, Bryan ranked up between the top 6 members of the Saturday Research symposium by developing a project entitled “A Sonar Device with the Capability of Detecting Biomass Estimates”. Throughout time, he has developed different researches and currently possess a kin grasp on different software developing such as Arduino Programing, Python Basics, Gamemaker Mechanics and Java Script. Moreover, from 2014 to 2017, His high school framework also included a series of robotic engineering events as he had taken part in the VEX Programs implemented in his ongoing academy. Other Topics such as oratory, In-depth Videogame design, and hardware development has also captured throughout the years but his ultimate goal is to graduate with All Honors in 2022 and uncovering an engineering job in the renowned SpaceX Program for years to come.

Diego E. Garcia Ortiz, Research Mentor and Alumni of Pre-College Research Program

Diego E. García Ortiz is an undergraduated student majoring in Natural Sciences with concentration in Biology at the Universidad Ana G. Mendez, Recinto de Gurabo. He participated 4 semester as a neurocircuitry student in the Saturday Research Academy, experience that give him the opportunity to participate in the Puerto Rico Institute for Microbial Ecology Research (P.R.I.M.E.R.) where with Dr. Lisandro Cunci he acquire knowledge on electrochemistry, developing a research about using Electrochemical Impedance Spectroscopy for the detection of neuropeptide Y. On the second semester of his second year he become an assistant mentor with Alexa Pérez in the area of Biological Sciences at Universidad Ana G. Mendez, Recinto de Gurabo research site. Diego is now working on a research proposal on how to use Electrochemistry to improve Alzheimer's Diagnosis and plans to continue his studies on Master's Degree on Pathological Sciences and a Doctorate on Neurobiology aiming to become a researcher to develop and improve treatments for Alzheimer's and other neurodegenerative diseases.

SCHEDULE OF EVENTS

SATURDAY, DECEMBER 7, 2019	ANA G. MENDEZ UNIVERSITY, GURABO CAMPUS

9:00 – 11.25 a.m.	POSTER/ORAL SESSION	THEATER

Chairperson: Dr. Angel Arcelay

NEUROSCIENCES

9:00 – 9:05 a.m. **Javier A. Avilés-Bonilla,** Science, Math and Technology Center of San Juan, San Juan, Puerto Rico.

EFFECTS OF SEROTON IN LEVEL IN BRAIN CIRCUIT: FLUCTUATIONS IN ENS

9:05 – 9:10 a.m. **Janelle Bachman Rodríguez,** María Reina Academy, San Juan, Puerto Rico.

ALTERATION OF DOPAMINERGIC NEUROCIRCUIT PATHWAYS: CANNABIS ADDICTION IN ADOLESCENTS

9:10 – 9:15 a.m. **Natalia I. Acosta-Laboy**, Colegio Rosa-Bell, Guaynabo, Puerto Rico

DYNAMICS OF MUCOPOLYSACCHARIDOSIS TYPE III IN BRAIN CIRCUITRY

9:15 – 9:20 a.m. **Juliana Gaztambide-Martí**, Academia María Reina, San Juan, Puerto Rico

ENDER DYSPHORIA IN TRANSGENDER TEENS: INTERNAL AND EXTERNAL STRESS FACTOR

9:20 – 9:25 a.m. **Adriana T. Godinez-Quiñones,** Academia Maria Reina, San Juan, Puerto Rico

EFFECT OF NICOTINE IN TEENS: DAMAGE OF BRAIN AND LUNGS

9:25 – 9:30 a.m. **Mariana B. Gutiérrez-Pagán**, Academia María Reina, San Juan, Puerto Rico

AMPHETAMINE PRESENT IN NEURAL CIRCUITS: DYNAMICS OF BEHAVIORAL AND POSSIBLE SIDE EFFECT

9:30 – 9:35 a.m. **Jude D. Rosa-Hernández**, Science, Math and Technology Center, San Juan, Puerto Rico

AN APPLICATION BASED ON CHALLENGES TO CHILDREN WITH ASPERGER'S TO STIMULATE THE PROCESS OF SOCIALIZATION

9:35 – 9:40 a.m. **Isabel Meléndez-Rivera,** María Reina Academy, San Juan, Puerto Rico.

EFFECTIVE STRATEGIES OF DUAL-COLOR IMAGING: MOLECULAR DISCREPANCIES IN ANALYSIS

9:40 – 9:45 a.m. **Gabriela Meléndez-Rivera**, Science, Math and Technology Center, San Juan, Puerto Rico

EFFECTIVE STRATEGIES OF DUAL-COLOR IMAGING: MOLECULAR DISCREPANCIES IN ANALYSIS

9:45 – 9:50 a.m. **Patricia Lozada-García,** Academia María Reina, San Juan, Puerto Rico

MUSIC AND ITS GENRES: AFFECTION ON THE EMOTIONAL STATE OF THE HUMAN

9:50 – 9:55 a.m. **Diana I. Ramírez-Ortiz**, Academia Maria Reina, San Juan, Puerto Rico

DISSOCIATIVE IDENTITY DISORDER: EFFECTS ON HUMAN EMOTIONS

9:55 – 10:00 a.m. **María Fernanda Vázquez-Rivera,** Academia María Reina, San Juan, Puerto Rico

DYNAMICS OF SEROTONIN: EFFECT OF OCD IN THE BRAIN

BIOLOGICAL SCIENCES

10:00 – 10:05 a.m. **Alexander R. Zambrano Tapia,** Specialized School of Science, Mathematics and Technology (CIMATEC), Caguas, Puerto Rico.

THE EFECT OF V-TYPE PROTON AT PASE SUBUNIT A OVER EXPRESSION OF ZOOXANTHELLAE IN ACIDIC WATERS

10:05 – 10:10 a.m. **Leonardo C. Zambrano Tapia**, School of Science, Mathematics and Technology, Caguas, Puerto Rico.

ANTIBIOTIC OVERUSE IN PEDIATRIC PATIENTS WITH ASTHMA EXACERBATION

10:10 – 10:15 a.m. **Waisamarie Arias-Berríos,** Radians School, Cayey, Puerto Rico

EFFECTS OF CLIMATE CHANGE ON MIGRATORY BIRDS

10:15 – 10:20 a.m. **Alejandra Álvarez-Rivas**, Academia Nuestra Señora de la Providencia, San Juan, Puerto Rico

UNDERSTANDING AND FINDING A WAY TO DIAGNOSE MYOCARDITIS

10:25 – 10:30 a.m. **Alejandro Maymí-Saez**, Academia Nuestra Senora de la Providencia, San Juan, Puerto Rico

SEARCHING FOR AN ALTERNATIVE AGAINST DUCHENNE MUSCULAR DISTROPHY

10:30 – 10:35 a.m. **Edgardo A. Santiago,** Escuela Especializada en Ciencias Matemáticas y Tecnología

5G NETWORK CONTRIBUTION IN THE FORMATION OF GLIOBLASTOMA MULTIFORM TUMOR IN GLIA CELLS

GAME DESIGN AND DEVELOPMENT, ATMOSPHERIC SCIENCE AND ENGINEERING, MARINE SCIENCE, ASTRONOMY, ASTROBIOLOGY AND GENOMICS, AND ENVIRONMENTAL NEUROBIOLOGY

10:35 – 10:40 a.m. **Kenneth Gabriel Sierra**, Carvin School Inc., Carolina, Puerto Rico

THE WAY OF THE BLADE: PREFRONTAL CORTEX STIMULATION VIDEOGAME

10:40 – 10:45 a.m. **Juan Antonio Pastoriza,** Carvin School Inc, Carolina, Puerto Rico

"BROKEN" INVIRORATING MEMORY AND PROBLEMS SOLVING VIDEOGAME

10:45 – 10:50 a.m. **Carolina I. Ferrer-Angulo,** Academia Maria Reina, San Juan, Puerto Rico

DEVELOPMENT OF A NOVEL ENGINE: LIMITING TOXIC GAS LIBERATION INTO THE ENVIORNMENT

10:50 – 10:55 a.m. **Alexander O. Molina,** Colegio Bautista de Caguas, Caguas, Puerto Rico

IONOSPHER ELECTRICAL CHARGES STUDY FOR ANALYSIS, IMPLEMENTATION AND FUTURE ENERGY CONSUMPTION

10:55 – 11:00 a.m. **Edgardo G. Sánchez Vázquez,** Escuela Secundaria Especializada en Ciencias, Matmaticas y Tecnología, Caguas, Puerto Rico

EFFECTS OF SPERM WHALE VIBRATIONS ON THE HUMAN BODY

11:00 – 11:05 a.m. **Xiam D. Roldan,** Colegio Saint Francis School, Carolina, Puerto Rico

GEOGRAPHICAL MOON POSITIONING PROGRAM AND PATH DEVELOPEMNT

11:05 – 11:10 a.m **Martín E. Fuentes-Quiñonez**, Colegio San Ignacio de Loyola, San Juan, Puerto Rico

THE EFFECT OF GRAVITATIONAL FORCE AND MUTAGENS ON THE HUMAN BODY AND ITS DNA

11:10 – 11:15 a.m. **Luis A. Martínez-Rivera**, University Gardens High School, San Juan, Puerto Rico

11:15 – 11:20 a.m

CORAL'S NEUROLOGICAL RESPONSE TO THE CHANGES IN THE ERODING COASTS OF PUE

Gianina María Medina-Neste, Academia María Reina, San Juan, Puerto Rico

11:20 – 11:25 a.m

EFFECT OF PHYSICAL ACTIVITY IN PRESERVING HIPPOCAMPAL VOLUME: HIPPOCAMPAL ATROPHY IN ADULTS

Rafael J. Torres-López, CIMATEC, Caguas, Puerto Rico 00725

VISUAL PROSTHESIS IN SIMULATION: POTENTIAL APPLICATION OF NEURAL NET

ABSTRACTS

NEUROSCIENCES

DYNAMICS OF MUCOPOLYSACCHARIDOSIS TYPE III IN BRAIN CIRCUITRY

Natalia I. Acosta-Laboy, Colegio Rosa-Bell, Guaynabo, Puerto Rico 00966

Research Mentor: Rubén A. García-Reyes, Polytechnic University, San Juan, Puerto Rico 00918

Mucopolysaccharidosis Type III, commonly known as Sanfilippo Syndrome or MPS III is defined as a neurodegenerative disease in children, acknowledged for provoking symptoms similar to those of autism, while impacting mainly the central nervous system. The Sanfilippo Syndrome is usually identified late in a child's life since these children do not start displaying the symptoms, which are: anxiety, speech, sleep, or conduct issues, until the ages of 2-5 years. This disease is commonly misdiagnosed based on the fact that the previously mentioned symptoms are similar to the ones of more common diseases, which causes patients to get diagnosed with those diseases rather than the one they actually have. This causes the patients to get a delayed diagnosis, causing them to lose the opportunity to acquire treatment earlier. Our focus was to help determine the effects this disease has on the central nervous system. A simulation was developed using the SimBrain software that enabled us to see how MPS affects existing neural networks and how the damage can severely alter brain function. We expect to see that electrical signals in cognitive areas of the brain to be the primary locations were damage is observed.

EFFECT OF NICOTINE IN TEENS: DAMAGE OF BRAIN AND LUNGS

Adriana T. Godinez-Quiñones, Academia Maria Reina, San Juan, Puerto Rico 00921

Research Mentor: Rubén A. García-Reyes, Polytechnic University, San Juan, PR 00918

One Juul pod contains the same amount of nicotine that one pack of cigarettes has. The Juul or e-cigarette is a battery-powered smoking device that contains a cartridge that contains oils to create a vapor; it comes in different flavors that are proven to appeal to the teens. The Juul is taking over teens, damaging their brains, cooking their lungs, literally. Today, many teens are lying in a hospital bed because their lungs are damaged. The effect it has in your lungs is that it irritates them since its hot vapor that one inhales. Consequently, your lungs slowly start to cook, which is called popcorn lung, and this could even lead to death, on the other hand, it can affect the development of the brain, making it harder to learn and concentrate. Some of the effects may be permanent in the brain as it affects mood and impulses. The method used to conduct this investigation is through a survey in which we compared with other studies found online. This survey was performed to collect and analyze data on how nicotine is affecting the lungs and brains of teenagers. With this in mind, we spread the survey through many teens that Juul and analyzed our results with the online results. We found that the majority of people who answered the survey are between the ages of 15 to 17 and are unaware of the amount of nicotine the Juul pod contains. The vast majority said that the reason they started was that they wanted to try Juuling. The main reason we are conducting this investigation is to make awareness of this severe problem that is affecting the lives of teens and even taking away lives some teens.

EFFECTS OF SEROTONIN LEVEL IN BRAIN CIRCUIT: FLUCTUATIONS IN ENS

Javier A. Avilés-Bonilla, Science, Math and Technology Center, San Juan, Puerto Rico 00921

Research Mentor: Rubén A. García-Reyes, Polytechnic University, San Juan, Puerto Rico 00918

Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest. Also called major depressive disorder or clinical depression, it affects how we feel, think, and behave and can lead to a variety of emotional and physical problems. Depression is the leading cause of disability and is a significant contributor to the disease burden worldwide. The global prevalence of depression and depressive symptoms has been increasing in recent decades. The lifetime prevalence of depression ranges from 20% to 25% in women and 7% to 12% in men. Tryptophan is an essential amino acid found in many protein-based foods, dietary proteins including meats, dairy, fruits, and seeds. Tryptophan is the sole precursor of peripherally and centrally produced serotonin. For central serotonin production to occur, tryptophan first needs to gain access to the central nervous system (CNS) via the blood-brain barrier (Jenkins, Nguyen, Polglze & Bertrand, 2016). Clinical and preclinical studies have used the tryptophan depletion model to investigate the idea that low serotonin synthesis is associated with depressed mood. Tryptophan depletion studies in never-depressed individuals are variable, with no or little overall effect on lowering of mood. Interestingly, reports of moderate mood lowering are seen more often in studies with healthy women than in studies with healthy men (Jenkins, Nguyen, Polglze & Bertrand, 2016). In this project, we investigated the effect that low levels of serotonin production in the enteric nervous system (ENS) had in the Raphe nuclei and demonstrated how tryptophan depletion affects the levels of serotonin production in the ENS. Also, Simbrain was used to model the GI tract and the Raphe nuclei. Molview supplemented a model of the amino acid tryptophan.

AMPHETAMINE PRESENT IN NEURAL CIRCUITS: DYNAMICS OF BEHAVIORAL AND POSSIBLE SIDE EFFECT

Mariana B. Gutiérrez-Pagán, Academia María Reina, San Juan, Puerto Rico 00921

Research Mentor: Rubén A. García-Reyes, Polytechnic University, San Juan, Puerto Rico 00918

Amphetamine is a drug that is used to help an individual's memory. If taken properly, this drug can help treat ADD, ADHD, Parkinson's, and narcolepsy. We wanted to find out if the drug has a different effect on various computational brains to examine possible secondary possibilities. Also, it was not clear what short-term effects and long-term effects had a big difference when it came to behavior. For this project, we manipulated the application “Simbrain” to simulate a person’s brain with the dosage in their system. We managed the Papez circuit that is in the hippocampus since it is one of the circuits that works with the memory region of the brain. Then, changed the levels of estrogen in simulation, considering it is the womans’ primal hormone and did the same for the male counterpart. These efforts should help provide more insight into how the drug interacts with the centers in charge of modulating behavior and inhibitions in the human brian.

ENDER DYSPHORIA IN TRANSGENDER TEENS: INTERNAL AND EXTERNAL STRESS FACTORS

Juliana Gaztambide-Martí, Academia María Reina, San Juan, Puerto Rico 00921

Research Mentor: Rubén A. García-Reyes, Polytechnic University, San Juan, Puerto Rico 00918

Gender dysphoria is the incongruence between a person's assigned gender and the gender which he/she/they identify as; one must be diagnosed with this to identify as transgender. People with gender dysphoria often experience extreme/significant mental health problems. Distress such as anxiety, depression, suicidal thoughts, isolation, among others, is common in these people. Among adolescents that experience major depressive episodes, transgender and gender non-conforming youth are three-13 times more likely to experience these type of mental health issues than cisgender youth. In this investigation, we set out to prove our hypothesis, which is, by measuring the biological and psychological stress in transgender teens, we will prove that gender dysphoria is the leading cause of internal and external stress factors in transgender youth. By using Simbrain, we conducted a neural circuit simulation to demonstrate how stress affects the composition of the stability of the computational brain. We gathered statistics of the number of transgender teens that live in the U.S., the depression statistics of teens in the U.S. (transgender vs. cisgender), the treatments given to transgender teens to help with their dysphoria, and areas of the brain that are affected by stress. With these efforts, we expect to find that gender dysphoria does indeed have serious effects on the expression of the disorder under study, but we aimed at measuring it quantitatively.

AN APPLICATION BASED ON CHALLENGES TO CHILDREN WITH ASPERGER'S TO STIMULATE THE PROCESS OF SOCIALIZATION

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Asperger's syndrome is a kind of disorder that causes the person to become either unable to socialize with others or only speak when they feel necessary. This syndrome normally occurs when the person develops it during pregnancy. As it is already known, those who have Asperger's are not good at communicating with others and are antisocial. This helps to continue previous projects such as those efforts with the syndrome of Asperger's. A computational brain with Asperger's syndrome was created using the program Simbrain to test the neural circuits related to socialization. This process is essential for the cognitive development of the individual. Stimuli were used to probe altered neural networks and examine the behavior obtained from the simulation while it is running. The data recovered from this project will be used to create a sort of game/challenge to see how should children respond to continued social stimuli in the real world.

MUSIC AND ITS GENRES: AFFECTION ON THE EMOTIONAL STATE OF THE HUMAN

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This project will focus on how music and its genres attack the emotional state of a human being. As this project is done, the results will reveal how music stimulates certain emotions through brain circuits. Creating a survey with appropriate questions about this topic, observing if any emotional change has occurred, using descriptive statistics, and performing interviews on people with different ages are all methods to carry out this project. The reason to pursue this kind of approach is to see why this affects so much the emotional state, especially on teenagers. Sending negative or positive thoughts to the brain, leads people to act according to those transmitted melodies. A solution to this problem in the short immediate term is to stop listening to certain genres of music if a person is too vulnerable at the moment. We have observed that music impacts many people and some even remember unforgettable memories by only listening to a chorus. When the final results are gathered, we expect to see some divide between genres and emotional states people endure.

EFFECT OF PHYSICAL ACTIVITY IN PRESERVING HIPPOCAMPAL VOLUME: HIPPOCAMPAL ATROPHY IN ADULTS

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The hippocampus is critical for the formation of new memories since it is involved in transferring information from short-term memory to long-term memory. Hippocampal atrophy is characterized when the hippocampus degenerates, and the patient experiences loss of neurons, which results in complications to form new memories. Previous research has proved that physical activity may preserve hippocampal volume since release of many hormones participate in providing a nourishing environment for the growth of brain cells. In this case, performing exercise supports hippocampal volume and function in late adulthood. Moreover, exercise excites brain plasticity by stimulating the growth of new connections between cells in a wide array of essential cortex areas of the brain. This project aims to prove that physical activity (PA) is a natural way to reduce hippocampal atrophy. PA is a definite option to create the ideal environment for a healthy hippocampus. To prove this, the program SimBrain was used to develop neural circuits where we compared two adults with AD. One of the adults performs physical activity one hour on a daily basis, while the other one does none. The simulation created in SimBrain is a visual representation of how the physical activity would affect positively or negatively the hippocampus. Each neuron group contains 30 neurons that are collected in the circuits CA1, CA3, and Dentate Gyrus. Previous investigations found that in humans (21–45 years), exercise selectively increased cerebral volume of the dentate gyrus which resulted in improved verbal memory. Based on our findings, physical activity prevents the development of hippocampal atrophy in adults.

EFFECTIVE STRATEGIES OF DUAL-COLOR IMAGING: MOLECULAR DISCREPANCIES IN ANALYSIS

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Alongside the constant growth of interest for neuroscience research has come an insisting need for stronger, unified knowledge on the human brain. Innovative techniques with immunohistochemistry have much potential in the further technological development of neuroimaging. By observing brain circuitry, localization of cognitive operations, and network interaction, we will be able to better comprehend behavior, understand brain capacities and mental functions/processes more accurately. Imaging methods are and will continue to be, crucial in unifying brain understanding in science. Typical immunohistochemistry methods tend to consist of the single staining approach. In this research, double staining (in the form of a dual viral strategy) was compared to a single viral one for co-expression of antibodies. Ideal labelling techniques were identified alongside optimal injection quantities utilizing immunohistochemistry by exploring this new approach to neuronal tissue labelling with double viruses (AAV9-flex-td Tomato and Syn-GCaMP7f). Quantitative analysis was conducted to examine the number of neurons that reflect the presence of a single or double antibody. Using both approaches, the aim was to demonstrate the efficiency that can be achieved in the tissue to produce more data from each slide. Furthermore, Fiji ImageJ provides a simple and direct way to examine how the adhesion of the biomarker's changes depending on the depth of the slice utilized. However, the expected results may show a different outcome as the way they were injected can have a serious effect in how the fluorescence expresses.

ALTERATION OF DOPAMINERGIC NEUROCIRCUIT PATHWAYS: CANNABIS ADDICTION IN ADOLESCENTS

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Cannabis addiction is described as a chronically relapsing disorder marked by compulsive drug seeking and intake, loss of control in limiting intake, and the emergence of a negative emotional state when access to the drug is prevented. Repetitive cannabis intake may lead to long-term effects such as cardiac, digestive, and pulmonary conditions. In addition to physical problems, a growing number of studies indicate that marijuana exposure during development can cause possibly permanent adverse changes in the brain. Such exposure mainly stimulates the reward system, where neurocircuits found in dopaminergic areas such as the limbic system and the prefrontal cortex become dangerously imbalanced. These imbalances can lead to other psychiatric disorders related to compulsive and impulsive behaviors especially if the patient began using cannabis at an early age. Furthermore, we used the program SIMBRAIN to build, run and analyze a visual representation of the neurocircuits found in the dopamine pathways. This simulation consists of neurocircuits found in dopaminergic pathways of a young cannabis addict and a non-addicted adolescent where we observed the differences in both neurocircuits. Additionally, the results were analyzed by plots in way of a time series that reflected differences in the fluctuation of electrophysiological charges. As a result, our graphs indicate that the electrophysiological charges in an addicted teen remain ecstatic, while the control subject experienced expected depolarization. Moreover, the dopamine levels found in the reward pathways of a cannabis addict are lower compared to a non-addict. These alterations in the neurocircuitry of a cannabis addicted adolescent negatively stimulate the reward system.

DYNAMICS OF PHOBIA IN NEURAL CIRCUITRY: POSSIBILITIES OF BEHAVIOR EXTINCTION

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The anxiety disorder known as a phobia mostly develops in the amygdala due to the pathological changes in the excitability threshold in fear circuits. The amygdala displays an increased activity in response to a threat stimulus. This investigation aimed to unconsciously decrease the degree of a social or specific phobia by creating a new memory, through mild-shock electric treatment and sound treatment. A small amount of electrical currents was passed through the amygdala during a party unconscious sleeping stage known as SWS, which refers to phase 3 sleep and which is the deepest phase of non-rapid eye movement (NREM). This current caused a seizure which provoked chemical changes in the brain. Thus, creating a new memory which consists on the confrontation of the phobia where a secure outcome is presented. The memory was created through stimulating sounds related to the situational phobia. For example, in regard to aerophobia (fear of flying), sounds such as the voice of a flight attendant, the buckling of seat belt and an airplane taking of, are incorporated in way of a standard tone produced by Simbrain; a neural circuit software. The electric shocks were conducted during slow-wave sleep since it is considered important for memory consolidation. In addition, sections of the brain that are important in memory – the hippocampus, neocortex and amygdala –are active during sleep. A dreamer's brain becomes highly active while the body's muscles are paralyzed and breathing, and heart rate becomes erratic. This way, the electric shocks did not provoke feel any kind of pain or discomfort.

VISUAL PROSTHESIS IN SIMULATION: POTENTIAL APPLICATION OF NEURAL NET

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The eye is a photoreceptor organ, it receives rays of light that are reflected from the objects and transforms them into electrical signals that the brain receives and interprets. According to the World Health Organization (2018), 36 million people are blind. A variety of therapeutic approaches have emerged to aid blind people. One of these is the use of visual prostheses, an implantable device that uses electrical currents to stimulate surviving retinal or cortical neurons to produce light percepts or phosphenes (Brandi, Luu, Guymer, & Ayton, 2016). Visual prosthesis can be implanted in various locations in the visual pathway from the retina to the visual cortex, so that the implant can bypass the damage. Current devices provide very limited vision, they allow patients to see spots of light. It is important to do research that contributes in the direction to understand how the human visual neural networks functions, to improve prosthetic software. This project's objective is to recreate the functions and inner workings of the visual neural net using the software Simbrain 3.0. To achieve our goal, multiple, neural circuits were developed and interconnected. While running the simulation we observed for any dead neurons and disabled connections serving as synapses that could affect the visual neural net. A series of plots enabled us to examine both the effect, structure and appropriate functioning of the network. When the simulation was completed, it was then stress tested to probe functioning regardless of hypothetical variables affecting the composition.

DISSOCIATIVE IDENTITY DISORDER: EFFECTS ON HUMAN EMOTIONS

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Dissociative Identity Disorder also known as multiple personality disorder is a complex post traumatic disorder that affects the behavior, consciousness, memory (amnesia), perception, cognition, and sensory-motor functioning of a person. In addition, it can lead to the detachment of a patient's self, and can also cause an unreal or distorted perception of people and things around the patient. According to "The Recovery Village", about 0.5% to 2% of the world's population has been diagnosed with some type of DID, and it is mostly diagnosed in women. Apart from this, previous studies also show that about 7% of the general population may have DID, but remain undiagnosed. However, this project focused on how Dissociative Identity Disorder affects human emotions. For this, we worked on Simbrain to compare how the limbic system of the human brain works in comparison with a diagnosed DID brain. Symptoms of DID may include the development of other mental health problems such as depression, anxiety and suicidal thoughts which are often linked to severe emotional sadness. Along with a sense of emotional numbness which may be linked to a problem in the amygdala that is the emotional processing center of the brain, in charge of responding to stimuli. By comparing a diagnosed DID brain with a normal human brain it was clear the difference in how the limbic system works in each one. This project is socially important because it is expected to help clarify the definition of DID in modern society. The final result of the project clearly portrays how Dissociative Identity Disorder affects human emotions.

DYNAMICS OF SEROTONIN: EFFECT OF OCD IN THE BRAIN

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Obsessive-Compulsive Disorder, OCD, is an anxiety disorder that causes the person who suffers from it to have obsessive-compulsive actions. These compulsions are due to recurring, unwanted thoughts, ideas, or sensations. These obsessive-compulsive actions can significantly interfere with the person's activities and social interactions. If these actions are not executed, this may cause significant distress to the person. The cause of OCD is not yet known, but researchers believe that differences in the brain and genes of the person diagnosed may play a role. It is also believed that problems between the communication of the front part and deeper structures of the brain influence OCD. With the information gathered of the orbitofrontal cortex, which is believed to be connected with the high-order cognitions like decision making, we designed a circuit in the software Simbrain. In this circuit, we ran the disorder to understand it better and saw the function of the cortex while it had the disorder. In OCD, serotonin levels have a significant effect; if they are too low, they are inclined to have a higher amount of compulsions. In the simulation, we manipulated the levels of serotonin and recorded the number of compulsions generated. After the plots were obtained, we expected to see the alteration, if any, on the behavior these circuits exhibit. Based on this, it is suggested that incline in activity is expected due to the nature of OCD.

ABSTRACTS
BIOLOGICAL SCIENCES

UNDERSTANDING AND FINDING A WAY TO DIAGNOSE MYOCARDITIS

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Cases of myocarditis have been documented since the early 1600s. It was formally discovered by Joseph Friedrich Sobernheim, a German physician in 1837. The purpose of this research is to propose an improved way to arrive at the diagnosis of said disease. We can diagnose this condition through electrocardiograms (ECG), Chest X-Ray, MRI, blood test, or echocardiograms. However, the treatment given to the patient depends on how far the disease has progressed. The following prescriptions are meant to help the heart mitigate symptoms. These are, Corticosteroid therapy (to help reduce inflammation), cardiac medications, such as a beta-blocker, ACE inhibitor, or ARB, behavioral changes (fluid restriction and low salt diet), diuretic therapy to treat fluid overload, antibiotic therapy. When the heart is extremely damaged, doctors may recommend a heart transplant in the worst-case scenario. To supplement our research efforts, we propose a combination of interventions to facilitate the job of each chemical compound ingested and arrive at a better outcome. The design of a new treatment plan should enable the patient who meets qualifying criteria benefit from an updated regimen of prescription drugs and/or therapies.

SEARCHING FOR AN ALTERNATIVE AGAINST DUCHENNE MUSCULAR DISTROPHY

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The project is based on the creation of a new protein treatment that can improve the old treatments by elaborating new ways to not affect the muscular and nervous systems. The treatment's priority is to slow the progression of the weakening in the distal muscles, especially in the hips, pelvic area, thighs, shoulders and in the calves. The Duchenne Muscular Dystrophy (DMD) is a genetic mutation in the X chromosome, that stops the body from producing a rod-shaped cytoplasmic protein called dystrophin and is an important part of the protein complex that connects the cytoskeleton of the muscle fiber to the extracellular matrix through the cell membrane of the muscle skeletal cell. When the protein treatment reaches the muscle cells where the mutation occurs it will introduce the same components that make dystrophin in the muscular cells. These repairs are to modify the protein in the cell and strengthen again the muscle fiber and protect the muscles from an injury that can be caused because the effects that made DMD. If the proposed treatment is used at the early stage when the patient is diagnosed with the condition, the treatment can react better reversing the effects that occurs in the gen.

EFFECTS OF CLIMATE CHANGE ON MIGRATORY BIRDS

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Changes in climate causes many problems for every species on Earth especially, the migratory species. They require suitable conditions throughout their annual cycle. Due to this ongoing environmental problematic, some migratory birds change their routes or even cancel their journeys and sometimes they even arrive earlier in the year to their breeding grounds. If these species arrive late, only by a few days, to their breeding grounds it may cause many problems for them. For example, when they arrive the food and it is not there anymore. The habitats migratory birds depend on during their migration are in danger and could even disappear due to increasing temperatures, flooding or desertification as they rely on these areas to provide food and resting places. Species that are already on the decline due to these factors are especially vulnerable. With this project, we aim to help raise awareness that if we continue the path we are on, the planet we call 'home' will become extinct. An interactive map of North America was used to propose a record of the chosen bird's migration path and how these alterations could cause environmental cascades that continue to worsen. With this data, an improved tool is provided to answer additional questions that could arise from the findings

5G NETWORK CONTRIBUTION IN THE FORMATION OF GLIOBLASTOMA MULTIFORM TUMOR IN GLIA CELLS

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Fifth generation wireless (5G) is a wireless networking architecture built on the 802.11ac IEEE wireless networking standard, which aims to increase data communication speeds by up to three times compared to its predecessor, 4G (IEEE 802.11n). 5G emits RF-EMF which is a type of electromagnetic radiation, in which electric and magnetic fields vary simultaneously. Glial cells are a supportive cell in the central nervous system, that do not conduct electrical impulses but supports and controls the neuron behavior. These cells, like any type of cell can be affected by radiation and develop tumors. In this project, cell profiler will be used to analyze the behavior of glial cells in a controlled radiation space. This project will be carried out to observe if glial cells subjected to radiation in equal to the 5G frequency will develop the glioblastoma multiforme tumor; a fast-growing glioma that develops from star-shaped glial cells. This type of tumor has been linked to cell phone use, with other networks. That proves that 5G will double or triple the appearance of the tumor. This project purpose is to aware people of 5G and its effects on glial and other nerve cells.

THE EFECT OF V-TYPE PROTON AT PASE SUBUNIT A OVER EXPRESSION OF ZOOXANTHELLAE IN ACIDIC WATERS

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Zooxanthellae is a dinoflagellate that typically lives in symbiosis with corals as they provide energy while the coral gives the zooxanthellae a protected environment. Zooxanthellae has a certain protein called "V-type proton ATPase subunit a" (V-TPATPase-A) that has the capability of turning H+ into energy which can be found in excessive amount on waters with acidic levels of pH turning them more basic. Using I-Mutant, which is a program that allows to analyze a protein behaivor on controled condditions, it was analized how the protein thrives in a more acidic enviroment. The data was collected and presented with a graph. The sequence of RNA of the protein will be obtained using the technique of (PCR) in order to mutate the plasmid. The purpose of this research is to implement the zooxanthellae's ability to absorb H+ in the water and utilize it to remove the acidity of the water that has been contaminated due to human pollution.

ANTIBIOTIC OVERUSE IN PEDIATRIC PATIENTS WITH ASTHMA EXACERBATION

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Historically asthma has been known to be a huge problem concerning public safety, approximately 26 million Americans suffer from asthma. (Asthma and Allergy Foundation of America, 2019) It is a chronic respiratory condition in which the lungs' airway become swollen upon exposure to cold and dry air, gases, dust or any other irritant, or allergens such as mold and pollen. Pediatric admissions are more common than adult admissions (Global Iniative for Asthma, 2017). The most common asthma relief and treatments are Short-Acting beta-agonist (SABA) and inhaled corticoresteroids. These two medications are used to treat asthma, but at times there are exacerbations caused by viral bacterial infection and require additional treatment. Even though bacteria are not always responsible for exacerbations, antibiotics are commonly prescribed to pediatric asthmatic patients even though they do not aid the improvement of the illness (Rita Mangione, Paul Krogstad, 2011). This may cause bacteria to create an unnecessary resistance towards antibiotics and a burden to pharmaceutical's job to synthesize new drugs (Richard Perry, George Braileanu, Thomas Palmer, Paul Stevens, 2018) It is important to identify if this is a problem concerning Puerto Rico. Statistical and background information were done in order to further understand the problem. Patients from 2-4 years of age were selected from the hospital's database, admitted in June 2016-July 2017. Their demographic information was acquired and placed in Data Extraction Sheets. Afterwards the data was analyzed with GraphPad, finding percentages and using a Mann Whitney test to compare patients prescribed with and without antibiotic treatment.

THE WAY OF THE BLADE: PREFRONTAL CORTEX STIMULATION VIDEOGAME

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The game developed through the Game Maker platform (free videogame development app) is going to be a retro 2D platformer where you play as a knight in a broken kingdom trying to find out what caused the kingdom's fall. During the game, different kinds of swords will appear to aid you in the quest, and all of them have different effects. As one of the examples go, some of the swords will swing slower but will deal more damage and others will swing faster but deals less damage. This game will not have 3D backgrounds and will instead be pixelated to facilitate development. The development has not been entirely easy but the implementation of many Easter eggs has been added. (An easter egg is an unexpected or undocumented feature in a piece of computer software or on a DVD, included as a joke or a bonus). The character will be unisex and will be called Orion. The character's face is never revealed for objectivity purposes. Another mechanic will be "mana". With "mana" you can cast different spells like a healing spell or a lightning spell. However, to gain "mana" you must attack enemies with your sword, effectively creating a risk and reward. This game will focus on using puzzles to help develop some basic cognitive skills. For example, one cognitive skill that will be developed will be multitasking and another will be color coordination. Of course, besides the basic game mechanics a pivotal fact to account for the project is the research question, and such one will be "Will I be able to develop a PreFontral cortex stimulation game based on color puzzle solving? Henceforth the answer to question is yes. Concluding the time in the Academy, the game was only developed 50%, but the integrations basics were added, including Easter eggs, puzzle solving and platform basic movement.

"BROKEN" INVIRORATING MEMORY AND PROBLEMS SOLVING VIDEOGAME

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Broken is a video game developed using the GameMaker platform with the main idea being to develop and most importantly stimulate certain areas of the brain when it comes to problem solving and memory, with this we specifically target the hippocampus and the frontal lobe part of the brain. The question is, Will it be possible to synthesize a Full Pledged videogame to stimulate Memory abilities in the brain? It is possible. to attack such dilemma? It was observed that people normally don't know about common shortcut keys which can help handle a pc easier to handle and much faster. To abide the common videogame structures it was decided that this game will be composed of several chapters each using new sets of shortcut keys for more complex puzzles. Puzzle solving in the levels mostly consists with climbing or jumping from side to side avoiding enemies around the platforms. All the sprites in the game were fabricated accordingly, each with animations of the character and other enemies. Each chapter there will be a door which leads to the beginning of the actual levels where each involves notes from past chapters. The main goal for this is that in the end people actually do get a good memory for where the different keys for the shortcuts are and know when and where to use them correctly and simply so that you can have fun while learning something new. Currently the game was created successfully, counting animation sprites and platform designs. The main levels have been created and the character is fully functional through all levels of design.

DEVELOPMENT OF A NOVEL ENGINE: LIMITING TOXIC GAS LIBERATION INTO THE ENVIORNMENT

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The way an engine works is through a stroke cycle that compresses derivatives of petroleum and creates energy. However, most engines liberate some type of fluid and in this case, it liberates toxic gases (such as carbon dioxide and carbon monoxide) into the environment. Our novel engine can reduce the liberation of toxic gases, since it is not based on a combustion process. This engine is composed of a water tank which will move the armature that produces electricity for a circuit that will direct energy to the engine. There will be a propeller attached to the water tank to move the armature in a certain direction. In this case, we would have an alternating current so it would be continuously flowing in one direction. The propeller will be powered by a rechargeable battery that will obtain its energy from solar panels built in the car. This engine, unlike combustion engines, releases vapor which, in large quantities, has the potential to contribute to the precipitation cycle. This intervention will cause more rain, which will increase the "green" (flora) in our planet. Also, since the car is being charged with a solar panel there is a limited velocity that most cars do not have, 40-80 miles per hour. This speed limit will prevent accidents from happening; therefore, there will be less deaths and injuries. Considering that these batteries cannot last for long periods of time, there would be multiple batteries in the car and when one's energy is expired the car will automatically change of energy source to another battery.

IONOSPHER ELECTRICAL CHARGES STUDY FOR ANALYSIS, IMPLEMENTATION AND FUTURE ENERGY CONSUMPTION

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The electrical charges are found in every place even in the sky. The surface of the Earth has his own negative charge one which it also attracts the positive particles found in ionosphere. The ionosphere receives his energy from the sun radiation that is expelled on a certain time. Studies have found that electrical charges extraction from the ionosphere can be a viable option of "free" electricity for small implementations with the purpose of scientific analysis and research. These studies have shown that there is a certain ratio of 100V/100m accordingly, but does this ratio becomes true when measured in an Island such as Puerto Rico and does temperature has any effect in the expected outcome? As part of this research I will be focusing in the analysis, study and implementation on how to collect and use these charges present in the ionosphere and measure the mentioned ratio. The general solution of this research is to find other variations of energy present to understand the functionality without the usage of common electrical generations, thus opting for less contaminating sources and to determine if the studies shown are true when measured in different weather conditions.

ABSTRACT
MARINE SCIENCE

EFFECTS OF SPERM WHALE VIBRATIONS ON THE HUMAN BODY

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The purpose of this investigation is to study the different frequencies that sperm whales use to communicate and differentiate from other whales and its effect in humans. In this investigation a comparison is make about the level of decibels and the spectrum that sperm whales use in communication. We studied them and find out what makes the frequency so dangerous. A human can feel whenever we are in a concert, the vibrations of low pitch sounds making our bodies vibrations different and changing our hear beats or when we hear a high pitch noise, we don't feel such vibrations, but it irritates us. Under water something similar happens with the sperm whale communications. Being able to change its decibels making its waves change lengths and can cause many effects in the organism affecting the homeostasis of the human systems. Using a decibel scale meter, we conclude the type of communication and its effect in human organism. We analyzed and compared to other whales to determine the different types of frequencies.

ABSTRACT
ASTRONOMY

GEOGRAPHICAL MOON POSITIONING PROGRAM AND PATH DEVELOPEMNT

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This project is mostly made to make the process of sending or reaching a lunar point easier for everything, it could be useful for finding many more things or making the process easier. Using cardinal points is always a most when it comes to the moon coordinates, craters are another thing we need to have in mind since it one of the things that define it and most importantly technology. So far this idea for has not been seen, thought or made before. Will it be possible to develop a Fully planned Prototype sketch to aid manned and unmanned expeditions to the moon? It is possible and for overall purpose research the craters that will be used for this project are; (For the key name purposes the following will be named Localization craters), Mare Imbrium – the largest crater on the moon, Moltke- smooth bowl- like shape with smooth walls, Tycho- it's a complex crater, has a well define crater rims and a central peak. Youngest crater in the moon, Schrödinger- a large basin and have a ring-shaped uplifted region in the center, South Pole-Aitken Basin – is the deepest crater on the moon. Oldest crater in the moon, Galileo & Galileo A- are the smallest named craters in the moon, Mare Tranquilitatis- was chosen because it is a relatively smooth and level area for the landing of Apollo 11. The list followed above implements the 7 seven most vital key points in data structure in the lunar geography. This point will allow the prototype plan ive created to localize path areas in the moon for manned and unmanned development and research programs for years to come. Each of the localization craters will be, and are currently been, 3d mapped and classified in a 360 degree compass which later on will serve as structural pinpoints for maps meant and developed for expeditions.

ABSTRACT
ASTROBIOLOGY AND GENOMICS

THE EFFECT OF GRAVITATIONAL FORCE AND MUTAGENS ON THE HUMAN BODY AND ITS DNA

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During the month of March, Scott Kelly was sent to space to examine the physical effects of space on a human body. The project came to find striking results, including physical growth, change in the length of telomeres and DNA fluctuations. The findings help the investigation proceed since it gives a start for the project. These new pieces of information highlight the dangers and precautions an astronaut or scientist while up in space must take. In addition to this, the data gathered will answer our deep space questions that refer to human survival in the void of space with the help of astrobiology and all its aspects. For this reason, an alternative pathway was required to pare down the dangers to ensure the safety of the investigators. A simulation was created to define the effects and components that affect the human body, both physical and internal aspects. Different types of subjects will be tested, including different types of mutations and environmental mutagens. We ran BLAST on NIH and NCBI databases and examined possible homolog genes that could be implicated in the damage experimented when exposed to excessive radiation. With the intel gathered from BLAST, we performed genetic alignments on the Geneious software to test integrity of genes and examine telomeres. Also, we performed genetic arrangement and testing on available gene pools online to probe possible scenarios where mutations are decreased to establish probable preventive measure for astronauts. We rendered a type of UV exposure in the International Space Station (ISS) and simulated changes in DNA structure on Earth. A statistical analysis of all genetic was implemented and the data obtained from the software to be employed was carried out. The expected results were that the radiation of the Sun was the mutation causing factor that affected the DNA, due to the closeness of the rays and their irradiating heat signature to the ISS when compared to the its closeness to the Earth. The effects of mutagens in space are incredibly harmful and a prevention must be found to continue the space exploration and to expand the knowledge of the universe and our own human bodies.

ABSTRACT
ENVIRONMENTAL NEUROBIOLOGY

CORAL'S NEUROLOGICAL RESPONSE TO THE CHANGES IN THE ERODING COASTS OF PUERTO RICO

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Since 2005, the coast erosion has become a problem affecting the marine biology of Puerto Rico. The coast of the island is mostly protected by the coral reefs, but since erosion has become a severe problem, the reefs are also disappearing. Marine biologist experts explain that coral reefs could disappear by the end of the 21s century, when the atmospheric carbon dioxide reaches 560 million parts per million the corals are expected to stop their growth and start disintegrating. This will affect the human population and many of its aspects, including shorelines, the size of continents and the submergence of islands. For this reason, an experiment is conducted to find a process to prevent this from happening. This research is based on the study of the coral's nervous system and how coastal erosion is affecting it. Due to the rising waves, corals are dying, leaving Puerto Rico unprotected. This research seeks to find how coastal erosion affects the nervous system of the coral, what causes them to die, leaving the island unprotected. It is important to study corals, since they are our main barrier of protection against waves, if corals are lost, most of our coasts would decrease, along with our marine ecology and most of the constructions that are on the coast.

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