

UNIVERSIDAD METROPOLITANA (UMET)

IS PROUD TO HOST THE

WINTER 2007 PRE-COLLEGE RESEARCH SYMPOSIUM

SHOWCASING MINORITY HIGH SCHOOL STUDENTS' MENTORED RESEARCH

Leadership at SUAGM/MIE Project:

Juan F. Arratia, Ph. D.
NSF/UMET MIE Project
Director and Principal Investigator

Wilfredo Colón, Ph. D.
MIE-Co-PI
Dean School of Science and Technology
Universidad del Este

Teresa Lipsett, Ph. D.
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School of Science and Technology
Turabo University

CAROLINA, PUERTO RICO

December 8, 2007

NSF/UMET/MIE

National Science Foundation (NSF) Sistema Universitario Ana G. Méndez (AGMUS) Model Institutions for Excellence (MIE)

MISSION

NSF/AGMUS/MIE is dedicated to transforming its institutions into nationally recognized undergraduate research institutions and models in science, mathematics, pre-engineering and technology. Mentoring undergraduates by research faculty is the cornerstone of the MIE Project. We believe that creative research is one of the best ways to prepare students to become persistent and successful in graduate school and in their professional careers. After eleven years of MIE experience, the Ana G. Méndez University System (AGMUS) through the Institutional Development Center will disseminate the best MIE practices into AGMUS campuses at Universidad del Turabo and Universidad del Este transforming the mission for the all System.

EXECUTIVE SUMMARY

The primary goal of the NSF/AGMUS/MIE cooperative agreement is to increase the number of BS degrees granted to underrepresented students in science, mathematics, engineering, and technology (SMET) at Universidad Metropolitana. NSF/AGMUS/MIE at offers a wide range of academic opportunities to science students from the Department of Science and Technology. Scholarships for underrepresented and low-income students are a major incentive for first-generation university students who enter the fields of science, mathematics, engineering, and technology.

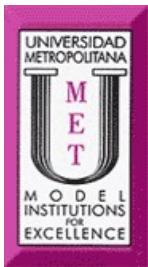
To increase the number of BS degrees and transfers to graduate school, we have put in place an undergraduate research program with a pre-college component for research activities at the high school level where potential young scientists are involved in science projects mentored by faculty members. Cooperative and collaborative learning strategies, presentations at scientific conferences, scientific writing and co-authorship, technology literacy, and preparation for graduate school are among the activities that are transforming the philosophy of the institution.

GOALS

The main goals of the AGMUS/MIE Research Symposium agenda are to encourage pre-college and undergraduate research with faculty and student research mentors; develop students' written and oral communication skills; provide the opportunity for students to share their research in a scientific environment; provide a forum in Puerto Rico for faculty and students to foster interest in graduate education, particularly at the Ph. D. level; and to set national research standards for pre-college and undergraduate research presentations.

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SISTEMA UNIVERSITARIO ANA G. MÉNDEZ

WINTER 2007 PRE-COLLEGE RESEARCH SYMPOSIUM

CONFERENCE AT A GLANCE

SATURDAY, DECEMBER 8, 2007		UNIVERSIDAD DEL ESTE
7:00 – 8:00 a.m.	Poster Session Set-Up/Continental Breakfast/ Registration	Library Vestibule
8:00 – 8:30 a.m.	Opening Ceremony Keynote Speaker Dr. Lloyd Douglas, National Science Foundation	“Salón de Actos”
8:30 – 10:30 a.m.	Poster Session	Library Vestibule
10:30 – 12:00 m.	Oral Research Presentations	
	Oral Session I	“Salón de Actos”
	Oral Session II	“Pasillo F Salón A-141”
	Oral Session III	“Pasillo F Salón A-143”
12:00 - 1:00 m.	Lunch	“Pasillo Principal”
	Keynote Speaker Dr. Eric M. Riggs, Purdue University	
1:00 – 2:00 p.m.	Award Ceremony and Closing Remarks	“Salón de Actos”
2:00 p.m.	Symposium Adjourns	





Universidad Metropolitana
MIE Project

December 8, 2007

Pre-College Students:

The Winter 2007 Pre-College Research Symposium is the culmination of the activities and dissemination process of the Saturday Academy Program of the Model Institutions for Excellence (MIE), a National Science Foundation sponsored program at Universidad Metropolitana (UMET). For a period of four months since August of 2007, more than one hundred-seventeen pre-college students from private and public high schools in Puerto Rico worked long hours in the research laboratories of the Departments of Science and Technology at UMET, Universidad del Turabo and Universidad del Este, and in the field with the guidance and mentorship of thirteen college professors and nine student research mentors in forty-eight research projects in the areas of biological sciences, chemistry, applied physics, environmental science, computer sciences, and engineering.

One of the objectives of the Winter 2007 Pre-College Research Symposium is to offer young motivated high school researchers the opportunity to learn and to practice their 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 results and findings of their research projects to teachers, researcher mentors, family members, and the university community at large.

The MIE Project is proud of the results obtained by the pre-college students and their mentors in the Fall 2007 Saturday Academy Program and the Winter 2007 Pre-College Research Symposium. I hope your experience inspires you and your peers to select science, technology, engineering or mathematics as your field of study in the near future.

My sincere appreciation goes to the MIE staff of the Pre-College Program, the MIE peer mentors and faculty from the Department of Science and Technology at UMET, Universidad del Turabo and Universidad del Este, for their effort and commitment to implement the Fall 2007 Saturday Academy Program and the Winter 2007 Pre-College Research Symposium. This event would not have been possible without the ongoing support of the National Science Foundation.

Sincerely yours,

Juan F. Arratia, Ph. D.
Director and Principal Investigator

ANA G. MÉNDEZ UNIVERSITY SYSTEM (AGMUS) PROFILE

As an Educational Institution

The Ana G. Méndez University System is home to approximately 30,000 undergraduate and graduate students who are mainly underrepresented low-income minority students from the Metropolitan San Juan area in Puerto Rico. Three institutions form the AGMUS University System: Universidad Metropolitana, Universidad del Este, and Universidad del Turabo. All have been teaching institutions since their foundation in 1948. Today, however, their philosophy has changed to address the students' study needs and the requirements of society. The President of the institution, Mr. José F. Méndez, has set the agenda for them becoming the best undergraduate research institutions in Puerto Rico. Additionally, the president has set the goal to implement the MIE best practices at Universidad del Turabo and Universidad del Este and transform AGMUS into a leading undergraduate research institution.

As an Undergraduate Research Institution

In 1995, UMET was selected by the National Science Foundation as a Model Institution for Excellence (MIE) school. At that time, a five-year Cooperative Agreement for more than \$11 million was signed between UMET and the NSF. A second Cooperative Agreement was signed on October 1, 2000 for an additional three years for \$7.5 million. A third phase of the MIE was granted in April 2004 with an additional investment of \$2.5 million. The main objective of the relationship with NSF was to transform UMET into a model for Hispanic Serving Institutions in the nation. The major goals were to enroll a considerable number of high school students in UMET's science offerings and to increase the number of BS degrees granted by UMET, to transfer a significant number of science students to graduate school, and to enroll them in Ph. D. programs to fulfill the goals and aspirations of a greater number of minorities in the science, mathematics, and engineering fields. The experience of transforming UMET into a national competitive undergraduate research institution where faculty research mentors help high school and undergraduate science students to create knowledge and disseminate creative thinking among the members of the university community will be shared with Universidad del Este and Universidad del Turabo. The Pre-College and the Undergraduate Research Program, sponsored by the National Science Foundation, are paving the way for research-oriented activities for the benefit of students and the nation as a whole.

PROLOGUE

The sponsorship of the National Science Foundation has been fundamental for the implementation of the Pre-College Program at Universidad Metropolitana (UMET). For twelve years, the Model Institutions for Excellence (MIE) Project has organized the Saturday Academy Program. In 2006, a new dimension was established with the dissemination of the MIE best practices into Universidad del Turabo and Universidad del Este (UNE). This Pre-College Research Symposium is part of a joint effort by officials from the School of Science and Technology at Universidad del Turabo and Universidad del Este. The main goal of this program is to motivate high school students to pursue careers in science, technology, engineering and mathematics at the BS and graduate levels. The Saturday Academy Program usually extends for sixteen weeks during the months of August through December. Students from public and private schools, enrolled in grades 10, 11 and 12, conduct research under the mentorship of faculty and student research mentors from the Department of Science and Technology and the MIE Project at UMET, UNE and Turabo. More than two thousand pre-college students have learned the fundamentals of scientific research through their participation in the Saturday Academy Program at UMET. For the last six years, a symposium has been organized to present the results of this activity to the university community and to motivate other Puerto Rican students to engage in scientific research. We are proud to have Universidad del Este and Universidad del Turabo as partners in this year's Winter 2007 Pre-College Research Symposium.

The Winter 2007 Pre-College Research Symposium held at Universidad Metropolitana on December 8, 2007 showcases the research experiences of one-hundred seventeen (117) pre-college students from fifty-two high schools in Puerto Rico. Forty-eight research projects are presented at the Symposium in the form of posters and oral presentations. The mentorship of twenty-two faculty and student research mentors from the Department of Science and Technology at UMET, UNE and UT made possible the concretization of the research projects. Their results are documented in the pages of this booklet.

The National Science Foundation, Universidad Metropolitana, Universidad del Este, Universidad del Turabo, and the Model Institutions for Excellence Project are proud of the research work conducted by the Saturday Academy Winter 2007 participants. We hope this Symposium will be a vehicle by which the scientific productivity of high school youngsters from Puerto Rico will be disseminated in future years.

KEYNOTE SPEAKER

Dr. Lloyd E. Douglas is Program Director in the Infrastructure Program of the Division of Mathematical Sciences in the Directorate for Mathematical and Physical Sciences at the National Science Foundation. He was born in New York. He attended The City College of New York, where he received a B.S. degree in Mathematics in 1972. He attended graduate school at Miami University, where he was a graduate assistant in the math department and assistant coach of the lacrosse team. He received an M.S. degree in Mathematics in 1974. He enrolled in Boston University's doctoral program in the mathematics department from 1974 to 1977 where he studied Algebraic Coding and held a Senior Teaching Fellowship in the department. He was also a mathematics tutor in the university's Resident Tutor Program. In 1976, he was hired as a Mathematician at the U.S. Naval Underwater Systems Center (now called the Naval Undersea Warfare Center) in Newport, RI. In 1979, he joined the Trident Command and Control System Maintenance Activity in Newport, RI as a Computer Specialist, where he was the on-site representative for the data processing subsystem on the first Trident submarines. From 1980-1983, he was an Operations Research Analyst at the U.S. Army Communications-Electronics Command at Ft. Monmouth, NJ. Then he moved to work at the U. S. General Services Administration in Washington, DC, as a Computer Specialist in the Office of Advanced Planning, where he engaged in Federal-wide technology assessment in automatic data processing and telecommunications. In 1984, he went to work at the National Science Foundation (NSF), where he held a variety of management positions in the Division of Information Systems before moving to the Division of Mathematical Sciences. During this time, he graduated from OPM's Executive Potential Program for Mid-Level Employees, where he had developmental assignments at the Internal Revenue Service as a manager in computer capacity management and at the Forest Service, USDA, as a telecommunications planner. In his spare time, he plays sports or studies foreign languages.

Dr. Eric Riggs is Co-Director of the Center for Research and Engagement in Science and Mathematics Education (CRESME) at Purdue University and Associate Professor in the Departments of Earth & Atmospheric Sciences and Curriculum & Instruction. Riggs is a member of the Earth System Science Education research group at Purdue University. He is also the President of the National Association of Geoscience Teachers, the premier professional society for geoscience education research and teaching and publisher of the *Journal of Geoscience Education*.

Riggs and his graduate students study many related aspects of field-based teaching and learning in the geosciences, focusing on issues of geoscience knowledge construction, spatial cognition related to geoscience expertise, and cross-cultural education. Riggs is the co-founder of the Indigenous Earth Sciences Project, based at Purdue since 2006, which is a research and outreach effort working to make geoscience education accessible and useful to Native Americans across North America. Riggs' scientific research is in the area of rock deformation, structural geology, and mineral physics.

SCHEDULE OF EVENTS

SATURDAY, DECEMBER 8, 2007

UNIVERSIDAD DEL ESTE

7:00 – 8:00 am.

POSTER SESSION SET-UP
Continental Breakfast
REGISTRATION

POSTER SESSION SET-UP

8:00 – 8:30 a.m.

OPENING CEREMONY

Keynote Speaker: Dr. Lloyd Douglas
National Science Foundation

8:30 – 10:30 a.m.

POSTER SESSION

LIBRARY VESTIBULE

BIOLOGY
CHEMISTRY
COMPUTER SCIENCES
APPLIED PHYSICS
ENVIRONMENTAL SCIENCES
ENGINEERING

Chairperson: Dr. Wilfredo Colón
Dean School of Science and Technology
Universidad del Este

BIOLOGY

Adrienne Torres, Saint Francis School, Carolina, Puerto Rico. (1)

Natalia Rivera, La Piedad School, Carolina, Puerto Rico.

Resistance of *Streptococcus pneumoniae* to Triclosan (5-Chloro-2-(2,4-Phenoxyphenol) Phenol Antimicrobial

Camila Trinidad, Isidro A. Sánchez High School, Luquillo, Puerto Rico. (2)

Nikole Ayala, **Xavier Nieves**, San Antonio de Papua Sschool, Fajardo, Puerto Rico.

Isolation and Differentiation of Enterohemorrhagic (EHEC) Organisms and *Escherichia coli* 0157:H7, in *Crassostrea rhizophorae* (Mangrove Oyster) Collected from Mar Negro Lagoon in Salinas and Piñones Lagoon in Loíza

Hendrick Álvarez, Nuestra Señora del Pilar School, (3)
Canóvanas, Puerto Rico.

Mariela Santiago, Bautista Rosa de Sarón School, Río Grande, Puerto Rico.

Isolation and Differentiation of Enterohemorrhagic Organisms and *Escherichia coli* 0157:H7, in Villas de Cambalache I, II, and Pedregales Swimming Pools in Canóvanas, Puerto Rico

Khrystal Alejandro, Nuestra Señora del Pilar School, (4)
Canóvanas, Puerto Rico.

Emmanuel García, Saint Francis School, Carolina, Puerto Rico.

David Miranda, San José School, San Juan, Puerto Rico.

Inhibition of *Escherichia coli* 0157:H7, with *Garcinia mangostana* (Mangosteen) and *Morinda citrifolia* (Noni) Juices at Different Concentrations

Natasha De Gracia, Jeylín Rodríguez, Nuestra Señora (5)
del Pilar School, Canóvanas, Puerto Rico.

Amnieris González, Berwin High School, San Juan, Puerto Rico.

Effects on the Growth and Development of Food Borne Disease Bacteria with *Lactobacillus acidophilus*

**Ariana Rodríguez, Stephanie Y. Negrón, Thania (6)
Martínez, Wilda M. Rivera**, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

A Computational Study of the Hazel Eyes Relation to OCA2: Predicting Amino Acid Substitutions Effect Thru Sift

CHEMISTRY

Verónica Cruz, Cristo de los Milagros Academy, (7)
Kelvin Majette, Sharon E. López, Manuel Toro Morice High School, Caguas, Puerto Rico.

Fatty Acid Composition of Caribbean Sea Urchins

Joyce M. Cotto, Verónica Flores, Ana J. Candelas High School, Cidra, Puerto Rico. (8)

Gloriemarie Peña, Manuel J. Santiago, José Gautier Benítez High School, Caguas, Puerto Rico.

Fatty Acid Composition of Caribbean Shellfish

Erika M. Hernández, Kathia Y. Castro, University Gardens High School, San Juan, Puerto Rico. (9)

Cosmetic Chemistry: Development of Different Formulas for Lip Gloss Confection

COMPUTER SCIENCES

Pedro M. Jiménez, Lemuel A. Rosa, Juan A. Rosa, (10)
Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.
Rosa G. Hernández, Amalia Marín High School, San Juan, Puerto Rico.

A Theoretical Analysis of Internet Cookies and Their Security Threats Using Javascript Language

Luis O. Betancourt, Thomas Alba Edison School, Caguas, Puerto Rico. (11)

Gerardo Cabrera, Jesús O'neill, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

Programming a Robot's Behavior in a Controlled Environment

John Delgado, San Ignacio School, San Juan, Puerto Rico. (12)

Luis A. Torres, Miguel De Cervantes High School, Bayamón, Puerto Rico.

Ángel Rodríguez, San Antonio School, San Juan, Puerto Rico.

The Hardware Design and Programming Involved in a Biped Robot

APPLIED PHYSICS

Eliz M. Centeno, Mayrel Morales, Luis Muñoz Iglesias (13)
High School

Nicole M. López, Corazón de María School,
Naomi Acevedo, Dr. Conchita Cuevas High School,

A Sphere Velocity in Viscous Fluids

Theydmara K. Hernández, Julianna Rivera, Eloísa (14)
Pascual High School,

Joel Fernández, Manuela Toro Morice High School,
Caguas, Puerto Rico.

Ninoshka Bernabé, República de Costa Rica High School,
Caguas, Puerto Rico.

Resistance, Resistibility, and Conductivity of a Conductor

Sebastián González, Ramón Vila Mayo High School, San (15)
Juan, Puerto Rico.

William O. Marrero, María Auxiliadora School, Carolina,
Puerto Rico.

Mariela Rivera, San Vicente de Paúl School, San Juan,
Puerto Rico.

Moon Shadow Theory

Karilis Ortiz, Nicole Pizarro, María Auxiliadora School, (16)
Carolina, Puerto Rico.

The Use of Space Technologies for the Improvement of
Health in Puerto Rico

Lianny De Jesús, Gabriel Rivera, William O. Marrero, (17)
María Auxiliadora School, Carolina, Puerto Rico.

Ian F. Santiago, Manuel Ramos H. High School,
Quebradillas, Puerto Rico.

Sebastián González, Ramón Vila Mayo High School, San
Juan, Puerto Rico.

Mariela Rivera, San Vicente de Paúl School, San Juan,
Puerto Rico.

Moon Base Design by High School Students of Puerto Rico

ENVIRONMENTAL SCIENCES

Carol S. Vélez, Episcopal Cathedral School, San Juan, (18)
Puerto Rico.

Lorena Serrallés, San Vicente de Paúl School, San Juan,
Puerto Rico.

Giselle Santos, Discípulos de Cristo Academy, Bayamón,
Puerto Rico.

Soil Analysis in Sector Suárez Beach in Río Grande, Puerto
Rico

Wilmarie Marrero, María Auxiliadora School, Carolina, (19)
Puerto Rico.

Global Warming, is it Real?

Alma C. Ramírez, Luz América Calderón High School, (20)
Carolina, Puerto Rico.

Comparative Study to Determine Acoustic Contamination
on the Surrounding of the Campus of Universidad del Este

Coralys Padilla, San Antonio School, San Juan, Puerto (21)
Rico.

Alejandra Márquez, Saint Francis School, Carolina,
Puerto Rico.

José P. Salcedo, María Auxiliadora School, Carolina,
Puerto Rico.

Development of a Model to Substitute the Refrigerant
Gases Freon 12 and the Hydroclorofluorcarbons for the
Refrigerant Gas BS-24 in Industrial and Domestic Air
Conditioners

Frances Rodríguez, Luis Rodríguez, La Piedad School, (22)
Carolina, Puerto Rico.

The Effects of Humidity Levels and Temperatura on the
Distribution of the Genus *Eleutherodactylus* in the Rural
Area of Cacao in the Municipality of Carolina, Puerto Rico

Amanda Torres, La Piedad School, Carolina, Puerto Rico. (23)
Ivette C. Ortiz, Lorenzo Vizcarrondo High school, Carolina, Puerto Rico.
Francheska Vigo, Berwind High School, San Juan, Puerto Rico.

Impacto f Urban Development on the Water Quality of the UNE Wetland

Geraldine Vega, Albert Einstein High School, San Juan, (24)
Puerto Rico.

Drought: Its Causes and Effects on Soils

ENGINEERING

Janemy M. Ríos, Katiria E. Esquilín, Berwin High (25)
School, San Juan, Puerto Rico.
Giovanni Rivera, Lorenzo Vizcarrondo High School, Carolina, Puerto Rico.
Mark Fendler, Santa Teresita Academy, San Juan, Puerto Rico.

Evaluation and Placement of a Movement Sensor Capable of Controlling Traffic

Giselle Blondet, Berwind High School, San Juan, Puerto (26)
Rico.
Emely Morales, Del Carmen Academy, Carolina, Puerto Rico.
Brenda Santana, Ángel P. Millán High School, Carolina, Puerto Rico.

Development of a Strategy to Reduce Accidents Caused by Drowsiness While Driving a Motor Vehicle

Bianshly Rivera, Luis G. Díaz, Alejandra Figueroa, (27)
María Auxiliadora School, Carolina, Puerto Rico.

Ergonomic Design of a School Desk to Reduce Backache

Zoraida Alvira, Nuestra Señora del Pilar School, (28)
Canóvanas, Puerto Rico.

Ismael J. De la Paz, Bárbara Ann Roessler Academy, San
Juan, Puerto Rico.

Timothy Rosa, Carlos F. Daniels Vocational High School,
Carolina, Puerto Rico.

Joan Palau, Calasanz School, Carolina, Puerto Rico.

Determination of the Placement of a Water Sensor to
Reduce the Entrance of Water into the Interior of a Car

10:30 – 11:40 a.m.

ORAL PRESENTATIONS SESSION I

“SALÓN DE ACTOS”

CHEMISTRY
COMPUTER SCIENCES
ENVIRONMENTAL SCIENCES

Chairperson: Dr. Juan F. Arratia
Director and Principal Investigator

CHEMISTRY

10:30 – 10:40 a.m.

Samuel Sánchez, Bárbara Bravo, Alberto J. Bravo, Eloísa Pascual High School,
Dianelly Rivera, República de Costa Rica High School, Caguas, Puerto Rico.

Fatty Acid Composition of the Caribbean Sand Dollar *Mellita quinquiesperforata*

10:40 – 10:50 a.m.

Ruth Dinardi, University Gardens, San Juan, Puerto Rico.
Luis R. Rivera, Libre de Música High School, San Juan, Puerto Rico.
Kimberly Rivera, Adolfina Irizarry High School, Toa Baja, Puerto Rico.

Synthesis of Soaps from Used Cooking Oils

COMPUTER SCIENCES

10:50 – 11:00 a.m.

Miguel A. Jiménez, Frank E. Martínez, José R. Pacheco, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

Developing A Dynamic Website for Educational Purposes

11:00 – 11:10 a.m.

Eduardo Álvarez, Menonita Academy, San Juan, Puerto Rico.
Russell Correa, Gabriela Mistral High School, San Juan, Puerto Rico.
Evy Marie Prado, Nuestra Señora de la Providencia Academy, San Juan, Puerto Rico.

The Biped Project

ENVIRONMENTAL SCIENCES

- 11:10 – 11:20 a.m. **Emmanuel Díaz**, Montessori High School,
Glorimarie Peña, José Gautier Benítez High School,
Christine Salas, José Campeche High School,

Water Quality Study on Valenciano River at the Alfonso Díaz Lebrón School Site, Juncos, Puerto Rico
- 11:20 – 11:30 a.m. **Bárbara De L. Bravo**, **Alberto J. Bravo**, **Samuel Sánchez**,
Eloísa Pascual High School, Caguas, Puerto Rico.
Manuel J. Santiago, José Gautier Benítez High School,

Bacteriological Study on Valenciano River at Alfonso Díaz Lebrón School Site, Juncos, Puerto Rico
- 11:30 – 11:40 a.m. **Ashleyanne P. Masa**, **Valery K. Masa**, Florencia García High School,
Annette J. Otero, SU Certenejas Middle High School,

Invertebrate and Small Fauna Survey at Alfonso Díaz Lebrón School Site Near Río Valenciano in Juncos, Puerto Rico

10:30 – 11:40 a.m.

ORAL PRESENTATION SESSION II

“PASILLO F
SALÓN A- 141”

COMPUTATIONAL BIOLOGY
ENVIRONMENTAL SCIENCES

Chairperson: Dr. Wilfredo Colón
Dean School of Science and Technology
Universidad del Este

COMPUTATIONAL BIOLOGY

10:30 – 10:40 a.m.

Ariana Rodríguez, Stephanie Y. Negrón, Thania Martínez, Wilda M. Rivera, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

A Computational Study of the Hazel Eyes Relation to OCA2: Predicting Amino Acid Substitutions Effect Thru Sift

10:40 – 10:50 a.m.

Víctor Correa, Inmaculada Concepción School, San Juan, Puerto Rico.

Liris N. González, José M. Maldonado, María Auxiliadora School, San Juan, Puerto Rico.

An Amino Acid Substituted Effect Prediction on Paired Box 6 (PAX6) Gene Mutation Utilizing Sifts

10:50 – 11:00 a.m.

Germán L. Vélez, Adianez School, Guaynabo, Puerto Rico.
Cristina I. Rivera, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

A Study of Measuring the Amino Acid Effects on the Disease-Associated Tuberous Sclerosis Complex 2 (TSC2) Gene Through the Use of Sift

11:00 – 11:10 a.m.

Asaria M. Jiménez, St. Mary’s School, San Juan, Puerto Rico.

Understanding Cystic Fibrosis Transmembrane Conductance Regulator (CTFR) Mutation by Jeans of SIAT Calculation

11:10 – 11:20 a.m.

Melizabeth Santana and Yea Jin Ko, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

SIAT Predictions of Amino Acid Substitution Effects on L1 Cell Adhesion Molecule (L1CAM)

ENVIRONMENTAL SCIENCES

11:20 – 11:30 a.m.

Kyrian López, Melvin Méndez, Manuel Ramos Hernández High School, Quebradillas, Puerto Rico.

Monitoring and Water Quality in Sector Suárez Beach in Río Grande, Puerto Rico

11:30 – 11:40 a.m.

Gabriela Salgado, Nuestra Señora del Pilar School, Canóvanas, Puerto Rico.

Comparative Study of the Clean-Up Technologies for Oil Spills in the North Coast of Puerto Rico Shorelines

10:30 – 11:20 a.m.

ORAL PRESENTATION SESSION III

“PASILLO F
SALÓN A-143”

COMPUTATIONAL BIOLOGY
ENVIRONMENTAL SCIENCES
APPLIED PHYSICS

Chairperson: Dr. Teresa Lipsett
MIE Co-PI
Universidad del Turabo

APPLIED PHYSICS

10:30 – 10:40 a.m.

Abisrael Morales, José Collazo High School,
Ashleyanne P. Masa, Valery K. Masa, Florencia García High School,
Marivelisse Meléndez, S.U. Vidal Serrano High School,

Liquids Viscosity in Terms of Terminal Velocity

10:40 – 10:50 a.m.

Nelson Rivera, República de Costa Rica High School, Caguas, Puerto Rico.
Paoli Bravo, Alberto J. Bravo, Eloísa Pascual High School,

“Characteristic Time T” for Liquids Cooling

10:50 – 11:00 a.m.

Dianelly Rivera, República de Costa Rica High School,
Eliz M. Centeno, SU Certenejas Middle High School,
Paoli Bravo, Rafael Quiñones Vidal Middle High School,

Identification of Riparian Vegetation in the Surroundings of the Alfonso Díaz Lebrón School in Juncos, Puerto Rico

11:00 – 11:10 a.m.

Sebastián González, Ramón Vila Mayo High School, San Juan, Puerto Rico.
William O. Marrero, María Auxiliadora School, Carolina, Puerto Rico.
Mariela Rivera, San Vicente de Paúl School, San Juan, Puerto Rico.

Luisa Fernanda Zambrano, Universidad Metropolitana, San Juan, Puerto Rico.

ENGINEERING

11:10 – 11:20 A.M.

Karlo E. Meléndez, Santa Mónica Academy, San Juan, Puerto Rico.

José R. Irizarry, Jorge A. Afanador, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

Robotics Simulation in a Controlled Environment (Road Interaction)

12:00 - 1:00 p.m.

LUNCH

“PASILLO PRINCIPAL”

1:00 – 2:00 p.m.

AWARD CEREMONY

“SALON DE ACTOS”

AND CLOSING REMARKS

2:00 p.m.

SYMPOSIUM ADJOURNS

ABSTRACTS

BIOLOGICAL SCIENCES

RESISTANCE OF *STREPTOCOCCUS PNEUMONIAE* TO TRICLOSAN (5-CHLORO-2-(2,4-PHENOXYPHENOL) PHENOL ANTIMICROBIAL

Adrienne Torres, Saint Francis School, Carolina, Puerto Rico.
Natalia Rivera, La Piedad School, Carolina, Puerto Rico.

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Streptococcus pneumoniae is a gram positive anaerobic, facultative, pathogen. Outbreaks of this pathogen have occurred in nursing homes and among HIV-infected persons in nosocomial (hospitals) and correctional facilities, in rural and urban metropolitan areas. *S. pneumoniae* is a health risk factor for the development of: Pneumonia, Otitis Media, Bacteremia, Meningitis, Peritonitis, and Sinusitis. Recent literature strongly suggests the emergence of drug-resistant strains of this pathogenic bacterium. *S. pneumoniae* is resistant to one or more commonly used antibiotics. Antibacterial products were developed and have been successfully used to prevent transmission of disease-causing microorganisms among patients, particularly in hospitals. They are now being added to products used in healthy households, even though an added health benefit has not been demonstrated. Scientists are concerned that the antibacterial agents will select bacteria resistant to them and cross-resistant to antibiotics. Five cultures of *Streptococcus pneumoniae* in Blood agar with different Triclosan (Penoxypheol antimicrobial) concentrations antibiotic disks were made. The experiment was repeated two times. The results from the study will be presented.

ISOLATION AND DIFFERENTIATION OF ENTEROHEMORRAGIC (EHEC) ORGANISMS AND *ESCHERICHIA COLI* O157:H7, IN *CRASSOSTREA RHIZOPHORAE* (MANGROVE OYSTER) COLLECTED FROM MAR NEGRO LAGOON IN SALINAS AND PIÑONES LAGOON IN LOÍZA

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The objective of this research was to determine if *Escherichia coli* O157:H7 was present in the *Crassostrea rhizophorae* (mangrove oyster) of the Mar Negro Lagoon in Salinas, PR and from Piñones Lagoon in Loiza, PR. Twelve (12) oysters were collected from a commercial vendor in each location and placed in a portable ice chest. In the laboratory, samples were taken from the mucus of the oysters and transmitted with a swab to a Fluorocult agar and incubated for a period of 48 hours. After the incubation period, an ultraviolet lamp was used to determine *E. coli* presence in each of the sample Petri dishes. A “Dye Gram” was also done to verify the presence of other bacteria. The outcome of the research revealed that there was a significant difference between the control and experimental groups. *Escherichia coli* O157:H7 was present in the Loiza Lagoon as well as in the Salinas Mar Negro Lagoon. However, it could not be determined if the amounts detected could result in the probabilities of infection through ingestion.

ISOLATION AND DIFFERENTIATION OF ENTEROHEMORRAGIC ORGANISMS AND *ESCHERICHIA COLI* O157:H7 IN VILLAS DE CAMBALACHE I, II, AND PEDREGALES SWIMMING POOLS IN CANÓVANAS, PR

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The objective of this research was to determine if enterohemorrhagic organisms and *E. coli* O157:H7 were present in Villas de Ambulante I, II, and Pedregales swimming pools. These particular swimming pools were studied because they showed poor signs of proper maintenance, the water presented a greenish tone and dead insects were prevalent. However, these swimming pools are open to the public and some signs are placed to warn people about the quality of the water. Twelve samples were collected, three from each pool. The samples were preserved in ice for transfer to the laboratory. The water samples were inoculated in Fluor cult *E. coli* O157:H7 Agar. Incubation was performed at 35°C for 48 hours. Enterohemorrhagic organisms were found such as *Escherichia coli*, *Salmonella typhimurium*, *Proteus mirabilis* and Sorbitol Negative Strain bacteria. The pool samples demonstrated an improper disinfection procedure. Even though *Escherichia coli* O157:H7 was not isolated, susceptible human populations, such as children and older people can be at risk when bathing in the Pedregales swimming.

INHIBITION OF *ESCHERICHIA COLI* O157:H7 WITH *GARCINIA MANGOSTANA* (MANGOSTEEN) AND *MORINDA CITRIFOLIA* (NONI) JUICES AT DIFFERENT CONCENTRATIONS

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This investigation was performed to analyze the inhibition of *Escherichia coli* O157:H7 with *Garcinia mangostana* (Mangosteen) and *Morinda citrifolia* (Noni) juices at different concentrations. The investigation was done two times. Six different juice concentrations (0.1%, 1%, 25%, 50%, 75%, and 100%) were prepared for each juice for a total of 24 samples. Antibiotic disks were previously submerged in juice concentrations and placed on different Petri dishes containing *E. coli* O157:H7. After inoculation was performed, samples were placed on an incubator at 35 °C for 48 hours. After the incubation period, no inhibition halos were observed in the samples. Results demonstrated that neither *Garcinia mangostana* (Mangosteen) nor *Morinda citrifolia* (Noni) juices at different concentrations were able to inhibit *Escherichia coli* O157:H7 growth.

EFFECTS ON THE GROWTH AND DEVELOPMENT OF FOOD BORNE DISEASE BACTERIA WITH *LACTOBACILLUS ACIDOPHILUS*

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Lactobacillus acidophilus is one of the most important bacteria found in the body, and generally resides in the digestive tract. According to the World Health Organization (WHO) Probiotics are live microorganisms that confer a health benefit on the host when administered in adequate amounts. *L. acidophilus* used as a probiotics may be used to prevent and treat antibiotic diarrhea, yeast infections, and urinary tract infections. It can also help the body by protecting against colon cancer and the adverse effects of chemotherapy and radiotherapy. Furthermore, they can be taken as a preventive measure against food poisoning. In this investigation the effectiveness of *Lactobacillus acidophilus* on inhibiting the growing of: *Helicobacter pylori*, *Salmonella typhimurium*, and *Escherichia coli* O157:H7 was researched.

UNDERSTANDING CYSTIC FIBROSIS TRANSMEMBRANE CONDUCTANCE REGULATOR (CTFR) MUTATION BY MEANS OF SIFT CALCULATION

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One of the main objectives of genome sequencing research is to provide an in-depth understanding of the genetics of disease and grant support with classification of disease-associated genes (1). Cystic fibrosis transmembrane conductance regulator (*CTFR*) functions as a chloride channel and controls the regulation of other transport pathways. Mutations of the *CFTR* gene affect functioning of the chloride ion channels in these cell membranes, leading to cystic fibrosis and congenital absence of the vas deferens. Disease mutations occur when an amino acid changes which produces a disease phenotype (1). This research focuses on tolerance and intolerance that the amino acid exchange creates. By utilizing *SIFT* (Sort Intolerable From Tolerable), a program capable of predicting whether an amino acid substitution affects protein function based on sequence homology and the physical properties of amino acids, calculations were made for protein sequences of *CTFR*, which produced predictions for positions 1 to 1,480 positions within the sequence and scores based on the amino acids appearing at each position in the alignment.

1. Miller M. P. and Kumar S., *Human Molecular Genetics*, 2001, Vol. 10, No. 21 2319-2328.

SIFT PREDICTIONS OF AMINO ACID SUBSTITUTION EFFECTS ON L1 CELL ADHESION MOLECULE (L1CAM)

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Amino acid mutations in a great number of human genes are recognized to be linked with transmissible genetics disease. One recognized disease-associated gene is the neural cell adhesion molecule L1 (*L1CAM*). The L1 cell adhesion molecule is one of a subgroup of structurally-related integral membrane glycoproteins belonging to a large class of immunoglobulin superfamily cell adhesion molecules (CAMs) that mediate cell-to-cell adhesion at the cell surface (*Kenwrick et al*, 2000). Mutations in the *L1CAM* gene cause neurological abnormalities of variable severity (*Basel-Vanagaite et al.*, 2006) such as CRASH syndrome, a collective term used to describe the range of disabilities caused by *L1CAM* mutations. Disease mutations take place during an amino acid exchange which generates a disease phenotype. The study focuses on the exchange of amino acids that produce these diseases. By using *SIFT*, a program capable of returning predictions for what amino acid substitutions will affect protein function, predictions were made and scores were calculated based on the sequences amino acid substitutions appearing at each position in the alignment of the sequences.

A COMPUTATIONAL STUDY OF THE HAZEL EYES RELATION TO OCA2: PREDICTING AMINO ACID SUBSTITUTIONS EFFECT THRU SIFT

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Hazel eyes are mutations due to a combination of a Rayleigh scattering and a moderate amount of melanin in the iris' interior border layer. One gene that causes this mutation is OCA2. OCA2 is oculocutaneous albinism II. The OCA2 gene supplies instructions for making the P protein. It is located on the long arm of chromosome 15. The P protein is located in melanocyte cells, which produce melanin which gives color to skin, hair, and eyes. There are two versions of OCA2: the brown (B) and the blue (b). The brown version is initially identified in Africans and African-Americans with light brown hair and skin. The cells with one copy of this gene make a reduced amount of the P protein, and this affects the coloring of the eyes. Other OCA2 mutations include changes in single DNA building blocks and small omissions. A mutation in this gene disrupts the normal production of melanin and, therefore, affects the coloring of the eyes, hair and skin. In this project the OCA2 gene was sequenced to provide a better understanding of the OCA2 gene. For the purpose of deeper understanding, a tool was used to sequence homology to predict whether a substitution affects protein function. SIFT (Sorting Intolerant from Tolerant), a program that sorts intolerant from tolerant substitutions within a protein sequence, was used to return predictions for what amino acid substitutions will affect protein function. Scores for positions 1 to 900 were calculated for each amino acid substitution that occurs within these positions.

AN AMINO ACID SUBSTITUTED EFFECT PREDICTION ON PAIRED BOX 6 (PAX6) GENE MUTATION UTILIZING SIFTS

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A paired transcription factor, paired box 6 (*PAX6*) is a regulatory gene for the development of eyes and sensory organs, as well as certain neural and epidermal tissues (*Yasuda et al, 2002*). The fundamental purpose of this research was to offer an understanding of the genetics of disease caused by the amino acid mutation in *PAX6* genes. Through the SIFT (Sort Tolerant From Intolerant) software, a program capable of predicting tolerations and deleterious substitutions for every position of the genomic sequence, predictions for positions 1 thru 100 that endure amino acid substitutions within the protein sequence alignment were produced and scores based on these substitutions were calculated.

A STUDY OF MEASURING THE AMINO ACID EFFECTS ON THE DISEASE-ASSOCIATED TUBEROUS SCLEROSIS COMPLEX 2 (TSC2) GENE THROUGH THE USE OF SIFT

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Tuberous sclerosis or tuberous sclerosis complex (TSC) is a rare, multi-system genetic disease that causes benign tumors to grow in the brain and on other vital organs such as the kidneys, heart, eyes, lungs, and skin. A combination of symptoms may include seizures, developmental delay, behavioral problems, skin abnormalities, lungs and kidney disease. TSC is caused by mutations on either of two genes, TSC1 and TSC2, which encode the proteins hamartin and tuberin respectively. These proteins act as tumor growth suppressors, agents that regulate cell proliferation and differentiation. In this work, SIFT (Sort Tolerant from Intolerant), a program capable of predicting the severity of an amino acid change and toleration to possible mutations, was employed to predict tolerance to amino acid substitutions in amino acid sites of the TSC2 protein sequence. Scores were calculated for positions 1 to 1,900 within the alignment of the protein sequences.

CHEMISTRY

FATTY ACID COMPOSITION OF CARIBBEAN SEA URCHINS

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The phospholipids' fatty acid composition of Caribbean purple urchins, collected at the Northeast of Puerto Rico, have been studied by fractionating the lipid classes, followed by transesterification of the phospholipids; and finally submitting the fatty acid methyl esters (FAME) to GC-MS analysis. All of these procedures were performed by following standard literature proceedings. The phospholipids' fatty acid content was composed of polyunsaturated fatty acids (PUFA) (27%); monounsaturated fatty acids (9%); and saturated fatty acids (64%). The main fatty acids found in these organisms were eicosatetraenoic (20:4), 17.6%; eicosenoic (20:1), 6.8%; and hexadecanoic (16:0), 48%. The fatty acid composition of the studied organisms resulted higher in the saturated fraction; average in the PUFA fraction; and lower in the monounsaturated fraction, compared to previous reports on phospholipids' fatty acid composition of Caribbean sea urchins. Identification of the species studied is pending.

FATTY ACID COMPOSITION OF CARIBBEAN SHELLFISH

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The phospholipids' fatty acid composition of tiny Caribbean shellfish, collected at the Northeast of Puerto Rico, have been studied by fractionating the lipid classes, followed by transesterification of the phospholipids; and finally submitting the fatty acid methyl esters (FAME) to GC-MS analysis; all of these procedures were performed by following standard literature proceedings. The phospholipids' fatty acid content was composed of polyunsaturated fatty acids (PUFA) (25.6%); monounsaturated fatty acids (16.6%); and saturated fatty acids (57.8%). The main fatty acids found in these organisms were eicosatetraenoic (20:4), 15.3%; eicosenoic (20:1), 5.4%; and hexadecanoic (16:0), 17.9%. The fatty acid composition of the studied organisms resulted higher in the saturated fraction; well below the average in the PUFA fraction; and average in the monounsaturated fraction, compared to some previous reports on phospholipids' fatty acid composition of shellfish. Identification of the species studied is pending.

FATTY ACID COMPOSITION OF THE CARIBBEAN SAND DOLLAR *MELLITA QUINQUIESPERFORATA*

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Dianelly Rivera, República de Costa Rica High School, Caguas, Puerto Rico.

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The phospholipids' fatty acid composition of the Caribbean sand dollar *Mellita quinquesperforata*, collected at the Northeast of Puerto Rico, have been studied by fractionating the lipid classes, followed by transesterification of the phospholipids; and finally submitting the fatty acid methyl esters (FAME) to GC-MS analysis; all of these procedures were performed by following standard literature proceedings. The phospholipids' fatty acid content was composed of polyunsaturated fatty acids (PUFA) (23.5%); monounsaturated fatty acids (18.3%); and saturated fatty acids (58.2%). The main fatty acids found in these organisms were eicosatetraenoic (20:4), 9.6%; hexadecenoic (16:1), 5.9%; and hexadecanoic (16:0), 32%. The species studied was identified by comparison with literature photograph and description. To the best of our knowledge, the fatty acid composition of Caribbean sand dollars had not been studied previously.

COSMETIC CHEMISTRY: DEVELOPMENT OF DIFFERENT FORMULAS FOR LIP GLOSS CONFECTION

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Research Mentor: Ileana I. Rodríguez, Ph.D; : Carolina Sánchez, School of Science and Technology, Universidad Metropolitana, San Juan, Puerto Rico.

The cosmetic industry is very important nowadays. These companies employ teams of specialized scientists to develop new lines of make up, lotions and soaps. Their research work leads to top-secret formulations that are carefully analyzed for further human use. Three basic lip-gloss recipes (emollient, wax, flavor or pleasant smell, color) were followed in the laboratory to see how they worked out. As a result, only one of the recipes resulted in a good lip-gloss product. The remaining two had to be adjusted using emulsifiers in order to improve the formula. In general, a little less beeswax in the formula makes the lip-gloss softer, but too much less beeswax turned the lip-gloss runny. An analysis of the shelf-life or stability of the products was also performed. It was determined that there is a need of preservatives in the formulas as they tend to change in color and texture as time goes by.

SYNTHESIS OF SOAPS FROM USED COOKING OILS

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The use of soaps is essential in a person's daily life; thus it is important to know how they are produced. Although it is not well known, most soaps are produced from vegetable or animal fats. However, most of the soaps confectioned for human use are made of vegetable oils, such as palm oil, oleic oil, coconut oil, among others. This study identified used cooking oils as a source of water contamination, as they are discharged directly to the sewage by restaurants and individuals. The main purpose of this research project was to use those wasted cooking oils for the synthesis of a useful and biodegradable product, soap. In addition to this, different fat proportions [saturated (lard) and unsaturated fats (used cooking oil, olive oil, peanut oil, etc.)] were used in order to change the physical properties of the soap. The saponification reaction was studied in depth as well as the physical properties (solubility, pH, hardness, soap effectiveness in soft and hard water, etc.) of the different soaps obtained from this experiment. Ultimately, a comprehensive comparison of the different products was achieved.

COMPUTER SCIENCES

A THEORETICAL ANALYSIS ON INTERNET COOKIES AND THEIR SECURITY THREATS USING JAVASCRIPT LANGUAGE

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Cookies are local files used by web servers to store information. They can store personal information, as well as web preferences on the user's hard drive. Cookies have several advantages and a few disadvantages. Some of the advantages include: better user experience and user capabilities that make the Web much easier to navigate. Many sites strictly rely on this function, and they are vital in storing personal information and online predilections. All of these advantages come at the expense of privacy and security. Therefore, the project's main objective is to learn the basic structure of a cookie, and with the gained knowledge, present and explain one already created in JavaScript. JavaScript is a scripting-language used to create codes that accomplish certain functions on a web page. The JavaScript cookie code was acquired from www.quirksmode.org, with the purpose of showing how a cookie is written and how it works. The project's intention was to make people aware of this subject and implant full understanding on what cookies do and what they can do to get rid of them. The motivation for this investigation is primarily to gain knowledge, not to attack the situation at hand, because cookies are already deeply merged into the complex constitution of the Internet. This data serves as an awareness alert and as an indispensable source for online protection given that Internet cookies serve as facilitations for identity theft and online behavior tracking. By presenting these security threats, the importance of the subject and its contribution with people who are not very well acquainted with computer comprehension are shared.

DEVELOPING A DYNAMIC WEBSITE FOR EDUCATIONAL PURPOSES

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Since its creation, the Internet has been a popular method of communication throughout the world. Millions of people use it, but only few know how it really works. This project focuses on the development of a website with the help of HTML-Kit (a versatile HTML editor). The main objective of the project emphasizes educating people about the Internet, its "languages," and how they can develop useful content for it. The website consists of several interactive tutorials, lessons and quizzes on subjects such as Hyper Text Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript. It is intended to guide the viewers through these languages interactively in order for them to be able to learn and develop their own dynamic web pages and content. The project's goal is not entirely limited to web-based languages, given that it may be applied to many other disciplines such as History, Science, and Mathematics. Furthermore, the team hopes to spread the idea to other places across the world.

PROGRAMMING A ROBOT'S BEHAVIOR IN A CONTROLLED ENVIRONMENT

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Robots have always been an interesting and popular subject in science and engineering. Sumobots are autonomous robots that attempt to push each other out of a ring. Sumobots are great tools that enable the easy learning of important skills for future programming in robotics. With the help of the Basic Stamp Editor program, a program was designed for the sumobot. The main goal of the project was for the robot to take its opponent out of a specific arena by using infrared sensors to measure the frequency that bounces objects, the distance between them, and at the same time avoid being pushed out. The robot ensures to stay in the arena perimeter by using QTI sensors, which detects the reflection of the surface. The sensors also help the sumobot not to get out of the ring by itself, because then the battle will be lost. One can modify the sensors by changing if it can attack or avoid its opponent. The command and programs of the sumobot can change for different environment depending on the situation. Outcomes of the study are included.

THE HARDWARE DESIGN AND PROGRAMMING INVOLVED IN A BIPED ROBOT

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The Honda ASIMO® robot was the first humanoid-biped robot ever developed. A biped robot is a robot that walks using two appendages like limbs that protrude from the body, simulating two legs. The main objective of the project focuses on analyzing, building and programming a biped robot that imitates human-like movements. Wooden parts were used to imitate the limbs, and servo motors to imitate the joints. Since wood is light enough for the servo motors to move, it was the optimal material to use in this case. The research team, with the help of Solid Works software, was able to sketch and design the parts with enough precision, enabling accurate pieces for the robot's construction. The software also helped the team sketch the model of the biped. Once built, the biped was programmed to mimic movements using BASICStamp Editor, a programming language from Parallax Inc. that facilitates instruction implementations.

THE BIPED PROJECT

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Robots are used every day for complex tasks such as medical surgery, space exploration, manufacturing or for simple tasks as vacuuming a house. The field of robotics has developed more and more in the way machines are made or how machines perform tasks that once seemed impossible to accomplish. The purpose the biped project was to design and construct a two-legged robot with the sole purpose of replacing immobile prosthetics with the purpose of having one fully functional. The construction of such robot takes some special materials such as servo motors for movements; the microcontroller, to control the movement operations; and a computer with the Basic Stamp software, to download the commands to the microcontroller. In order to design a prototype, Solid Works 2007 was used. This software includes many features which lets a designer input different measurements and geometrical theorems into making parts, matching them, and successfully constructing the machine. The biped robot completely met the original design criteria specified in the blue prints that were provided by Solid Works 2007. The current status in the biped project is the stage of assembly for the different complex and precise parts. The group's productivity will ensure the assembly and programming of this work of engineering.

APPLIED PHYSICS

RESISTANCE, RESISTIBILITY, AND CONDUCTIVITY OF A CONDUCTOR

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The relationship between resistance, resistibility and conductivity of a conductor cable as its longitude changes (40, 80, 120, & 200 cms.) was demonstrated experimentally. Using a simple electrical circuit, various voltage measures of electrical current were taken for each piece of cable in terms of its longitude. Ohm Law was used to calculate the experimental value of the resistance of each piece. Once the value of the resistance was obtained, the area of the transversal cable (s) was calculated. A linear relationship between the experimental resistances versus the cable longitude was observed. The slope of the line represents the resistibility of the material in terms of its area (p/s). By knowing the area, the resistibility value of the material was determined. The experimental data showed that when the conductor cable longitude increases, the resistance also increases. The ohm performance of the conductor was observed and the material resistibility and conductivity values was determined in this study.

“CHARACTERISTIC TIME T” FOR LIQUIDS COOLING

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The cooling behavior of various liquids, such as water, vegetable oil, car oil, and shampoo were studied. The *characteristic time* value (τ) for the liquids cooling was found for each type of liquid studied. The parameter τ presents how fast the liquid cools out. The liquids were warmed up, then data related to the temperature at different times was obtained until it reached ambient temperature. Graphs showing temperature as time function were prepared. Data was analyzed using Newton's cooling law. It was observed that temperature decays exponentially. Hot liquids tend to cool out faster when they are very hot, and then slow down as they reach ambient temperature. The experimental τ value for water was equal to 12.45 s, for car oil is 13.30 s, for shampoo is 18.95 s, and for vegetable oil is 12.49 s.

LIQUIDS VISCOSITY IN TERMS OF TERMINAL VELOCITY

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Ashleyanne P. Masa, Valery K. Masa, Florencia García High School,
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There is a great variety of equipment in industry to measure a fluid's viscosity. The experimental objective of the project was to measure the viscosity value of water and vegetable oil with less sophisticated materials. A simple pulley or Machine of Atwood was assembled. The machine holds in one extreme mass and in the other extreme a sphere. The sphere was immersed and held in the fluid and then released. A sensor was used to graph the velocity of the sphere going up as a function of time. The acceleration was measured as well. The graph of sphere velocity going up versus time showed a non lineal ascent, but as time went by the velocity tended to be constant, indicating that the sphere had reached its final velocity. Using Newton's Second Law and once the system's acceleration, the cord tension, the mass, the radio of the sphere, the suspended mass and the known fluid density, the viscosity value of each liquid was determined.

A SPHERE VELOCITY IN VISCOUS FLUIDS

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The behavior of terminal velocity of a sphere that was dropped in different fluids was studied. The coefficient of viscosity of water and vegetable oil was determined in an experimental form. To measure the terminal velocity the sphere was dropped out in the fluid where a sensor registered and graphed the distance traveled by the sphere in terms of time. The graph showed a lineal tendency. The slope of the line represented the value of the terminal velocity. It was concluded that when a physical body reaches its terminal velocity it is not accelerated. Using Newton's Second Law and through the calculation of the thrust done by the fluid over the sphere, the weight, the diameter of the sphere and the fluids' density, the coefficient of viscosity for each fluid was determined.

MOON TIME VS. EARTH TIME

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William O. Marrero, María Auxiliadora School, Carolina, Puerto Rico.

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The human race has always shown a particular fascination with the Moon. The Moon is the only natural satellite of the Earth. It is also the only celestial body to which humans have traveled. In the past years, different countries have been trying to partake in the human exploration of it. The Moon orbits around the Earth; that movement along with its rotation period and the position of the Earth and Sun is the reason why we can observe different moon phases. The team developed a keen interest in this project and decided to investigate if the Moon's rotational period has changed over time. Past measurements have shown that the Moon month is comprised of 28 Earth Days. This information, along with other astronomical observations gathered by the team, will enable the group to calculate the conversion of a Moon's day, hour and year in Earth as well as understand what causes the difference in time between the Earth and the Moon. By observing the Moon in its November cycle, the information on how long it takes for these transition phases to be completed will be obtained. The observations will be done using telescopes provided by members of the Astronomical Society of Puerto Rico. The telescopes used by the team ranged from 4 inches to 8 inches and the lenses from 20mm to 80mm. Through this project, the team was able to understand the importance of the scientific method and the challenges that arise in the development of a research project.

THE USE OF SPACE TECHNOLOGIES FOR THE IMPROVEMENT OF HEALTH IN PUERTO RICO

Karilis Ortiz, Nicole Pizarro, María Auxiliadora School, Carolina, Puerto Rico.

Research Mentor: Luisa Fernanda Zambrano, Universidad Metropolitana, San Juan, Puerto Rico.

In the past, Cancer and Malaria were rare diseases that now are very common. They are spreading around the world with Malaria being considered a plague. At the time, there was no cure. Now, with space technologies, a cure might be found now. The purpose of this research was to investigate and find new ways to improve life in other countries. A comparative table was made in which life with space technologies was compared with life without them. It was found that there are certain spinoffs nowadays that help the improvement of health in Earth. These spinoffs are the voice-controlled wheelchair, ultrasound skin damage assessment, and breast cancer detection. Four years ago, NASA scientists created a machine called the Robo Doc. Its purpose is to assist in the health care of astronauts in space. If health care systems in Earth are revolutionized, in a near future, an end to major diseases like Malaria, HIV and Cancer will be eliminated.

MOON BASE DESIGN BY HIGH SCHOOL STUDENTS OF PUERTO RICO

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Following the increasing interest in space exploration of multiple governments, and the continuous interest of society in space exploration, a team has taken the challenge of selecting the most appealing Moon base design. The Luna Gaia Moon Base Design from the International Space University Summer Space Program (05) was selected by the team as well as by NASA to be the basic design for the Moon base that is to be built in the coming years. The team built a Scale Model (1cm: 1m) of Luna Gaia, making changes in its module design, layout and room occupancy. Designing and building a habitable self sustaining base for humans to inhabit is not the main challenge of a project like this one, but to make these design concepts feasible in a low gravity environment which carry incredible costs are the main challenges faced by space exploration. A closed loop habitat system that can be transported and assembled in the Moon is a priority for the future of the exploration of the solar system. A folding module mechanism is presented as an alternative for transport. The Scale model presented includes 8 modules and 1 greenhouse. Each module has been designed taking into consideration the functionality as well as the adaptability to low gravity. The closed loop system of the base will allow for locking modules in case of emergencies. Although the development of a base of this size will take several space missions, it is a concept that has already undergone studies and begun construction in space agencies around the world like the Chinese National Space Administration (CNSA), the National Space and Aeronautics Space Administration (NASA) and the Canadian Space Agency (CSA).

ENVIRONMENTAL SCIENCES

WATER QUALITY STUDY ON VALENCIANO RIVER AT THE ALFONSO DÍAZ LEBRÓN SCHOOL SITE, JUNCOS, PUERTO RICO

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Glorimarie Peña, José Gautier Benítez High School,
Christine Salas, José Campeche High School,

Research Mentors: Prof. Gerardo Franco and Prof. Antonio González, Universidad del Turabo,
Gurabo, Puerto Rico.

Through this investigation the effects of septic contamination into the Valenciano River in Juncos was analyzed. Four sampling points were identified at the Valenciano River. Thirty-six samples were taken and tested in the laboratory to determine the pH, dissolved oxygen, temperature, and microbiology. After examining the micro growth several fungi specimens were found.

BACTERIOLOGICAL STUDY ON VALENCIANO RIVER AT ALFONSO DIAZ LEBRÓN SCHOOL SITE JUNCOS, PUERTO RICO

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Water is an indispensable resource. Watersheds in Puerto Rico are the source of potable water for all citizens and all commerce and industries. Based on this premise, it is necessary to study water to ascertain how potable it is. The quality of the Valeriano River waters was studied at some points to determine the level of contamination of the river. This study will help citizens to understand the importance of the river and to eliminate and reflect on how contamination factors may be eliminated. The water samples were put under detection tests of pH, dissolved oxygen and fecal coliforms cultures.

INVERTEBRATE AND SMALL FAUNA SURVEY AT ALFONSO DÍAZ LEBRÓN SCHOOL SITE NEAR RÍO VALENCIANO IN JUNCOS, PUERTO RICO

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Identification and classification of species is important to learn about the characteristics of a place. The goal of this research was to observe, photograph, and identify the different species of fauna located in the Valenciano River in Juncos, Puerto Rico. Twenty three species were identified including fire ants, lizards, green stink bugs, and butterflies, among others.

IDENTIFICATION OF RIPARIAN VEGETATION IN THE SURROUNDINGS OF THE ALFONSO DÍAZ LEBRÓN SCHOOL IN JUNCOS, PUERTO RICO

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This study presents an inventory of vegetation found in the Valenciano River surroundings in Juncos, Puerto Rico. The research field for the inventory was divided into six areas. The vegetation found was classified by common names, scientific names, families, and their description. The objective of the survey was to determine what types of vegetation are currently at the site. The final objective is to educate the community of the vegetation that is endemic of the area.

MONITORING AND WATER QUALITY IN SECTOR SUÁREZ BEACH IN RÍO GRANDE, PUERTO RICO

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Research Mentors: Prof. Ileana I. Rodríguez, Ph.D; Carolina Sánchez, Department of Science and Technology, Universidad Metropolitana, San Juan, Puerto Rico.

This year, some beaches in Puerto Rico have closed due to health warnings, since they have been highly polluted with human and animals residuals. As a result, there have been many illnesses caused by these infected waters. Beaches are not only for the swimmers' attraction, but rather they are of supreme importance for all organisms. The purpose of this study was to show concrete data that will help take into account laws that protect the public to avoid affecting the health of the population and the economy. During the beach monitoring, the biochemical and bacteriological parameters were collected in three different areas chosen randomly: estuary, buildings and erosion, and vegetations of Sector Suárez in Río Grande. An easy and economic product was to determine the fecal coliforms presence in the water. The same one is Coliscan Easygel; it is safe, easy and inexpensive. There was no need of any expensive equipment or long hours of prep time. With a new agar substitute, Easygel, this eliminates the need for an autoclave, water bath and balance to prepare media for this experiment. With Coliscan Easygel, it was determined whether fecal coliforms were present in water. Finally, good and specific results that helped to produce quick and efficient conclusions for the identification of the bacteria as indicators of the contamination were obtained. The results will be presented.

SOIL ANALYSIS IN SECTOR SUÁREZ BEACH IN RÍO GRANDE, PUERTO RICO

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Many of the environmental problems that humanity faces include pollution, bad use of natural resources, and global warming. Coasts are being affected by these changes in the environment. This research that was carried out on the soil of three different areas chosen randomly: estuary, buildings and erosion, and vegetations of Sector Suárez Beach in Río Grande. During the experiment, different environmental variables of the soil (temperature, humidity, fertilizers, pH, light capacity, texture and salinity) and air (velocity of wind and temperature) were collected. The fertility of the soil was ascertained to determine if it was eligible to support plants' growth or if it provided nutritive elements for its development. This investigation revealed a significant change in the areas due to geological changes in the climate, the animals residing near, erosion and construction of buildings near the coast, and solid waste that affects the development and nutrition of the soil. The results will be presented.

GLOBAL WARMING, IT IS REAL?

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Research Mentor: Dr. Vernon Morris, NOAA Center of Atmospheric Science, Howard University, Washington DC.

Global Warming is the slow increase of the earth's surface and atmosphere temperature due to the presence of greenhouse gases in the atmosphere. The principal theory is the Greenhouse effect, caused by some gases, which trap the sun radiation and act as a sort of "thermal blanket" that is keeping the Earth within a mostly livable temperature. However humans are increasing the levels of these gases in the atmosphere which means that more heat is getting trapped and turns heating up the earth and causing a variety of problems. Some scientists question the global warming hysteria, and say that global warming is not occurring, while others say that global warming is caused by natural processes or that the causes for global warming are unknown. Finally this process may be a natural cycle, but human beings are only making it worse. Whether it is real or not, people need to be aware of the different points of view on this issue.

DROUGHT: ITS CAUSES AND EFFECTS ON SOILS

Geraldine Vega, Albert Einstein High School, San Juan, Puerto Rico.

Research Mentor: Dr. Vernon Morris, Howard University, Washington D.C.

Many countries worldwide are affected by droughts. They are part of the large natural disasters of the planet and there are many people who are not aware of the magnitude of this problem in spite of the fact that each year droughts are getting worse as a result of global warming. This work describes what a drought is and its causes, as well as the differences among droughts depending on the type of soils. The devastating consequences of droughts are included.

COMPARATIVE STUDY TO DETERMINE ACOUSTIC CONTAMINATION ON THE SURROUNDING OF THE CAMPUS OF UNIVERSIDAD DEL ESTE

Alma C. Ramírez, Luz América Calderón High School, Carolina, Puerto Rico.

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A report by the World Health Organization (WHO) determines that 65 decibels is the maximum desirable limit for sound for human exposure. The importance of this experiment was to determinate the harmful levels of acoustic contamination on the three main roadways that surround the Campus of Universidad del Este. The finding of this investigation showed that the Baldorioty de Castro expressway registered 93 decibels, Campo Rico Avenue 92 decibels, and Road 190, 85 decibels. These three roadways surround the UNE Campus and show the high level of acoustic contamination that people can be exposed to in the surroundings of the university.

COMPARATIVE STUDY ON THE CLEAN-UP TECHNOLOGIES FOR OILS SPILLS IN THE NORTH COAST OF PUERTO RICO SHORELINES

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Since the Morris J. Berman oil spill occurred in January 7, 1994, the use of the Bunker C oil has increased, including the possibility of another spill of this type of oil. This project compares what would be the most effective activity of Bunker C cleanup assessment in the north coast of Puerto Rico so that, if a new oil spill occurred, there would be a quick response knowing that “this” kind of cleanup technology is the right one and not a waste of time and money. The clean-up assessments that were studied are the vacuum trucks, solvents, dispersants, manual excavation/removal, high and low pressure cleaning, and skimmers and booms.

IMPACT OF URBAN DEVELOPMENT ON THE SOIL QUALITY OF THE UNE WETLAND

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Francheska Vigo, Berwind High School, San Juan, Puerto Rico.

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Wetlands are terrains covered by superficial or subterranean water, in a frequent enough duration that permits the growth of wetland plant species. The UNE wetland is classified as a palustrine system and the dominant plant species in the southern cattail *Typha domingensis* Pers., which is also known as Enea in Spanish. A wetland in good conditions is one considered a healthy and functional ecosystem. The possible cause of the deterioration of the wetland is the urban development in the surroundings due to the introduction of waste materials, changes in the flow of water, atmospheric and soil contamination. Three (3) soil samples were taken on three separate occasions from three (3) quadrants within the wetland and the pH and other chemicals, as well as the physical parameters were determined to ascertain the level of possible contamination to this ecosystem. The pH levels of all samples was 7, nitrate levels were low, phosphorus levels of one quadrant were high, and potassium levels of all the samples were high. Further studies should be conducted to determine the source of the potassium that is entering into the wetland.

DEVELOPMENT OF A MODEL TO SUBSTITUTE THE REFRIGERANT GASES FREON 12 AND THE HIDROCLOROFLUORCARBONS FOR THE REFRIGERANT GAS BS-24 IN INDUSTRIAL AND DOMESTIC AIR CONDITIONERS

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Ozone depletion in the upper atmosphere is the result of human-produced chemicals, such as chlorofluorocarbons (CFCs). The Montreal Protocol signed in 1987 and the Kyoto Protocol adopted in December 1997 have led to a phase out of most CFCs use. However, CFCs last for a long time in the atmosphere, so it will be some decades before the ozone layer completely replenishes itself. Air conditioners are a main culprit for ozone depletion because they use refrigerant gases like Freon-12 and hydrochlorofluorocarbons that are a type of CFCs. If the Freon-12 and the hydrochlorofluorocarbons for the hydrocarbons isobutane (methylpropane) and propane called gas LB-12 are substituted as a refrigerant gas in industrial and domestic air conditioners, this change can result in a radical diminution of CFCs that contribute to ozone depletion. The study attempted to identify the sources of this gas in Puerto Rico and run some tests to verify if a domestic air conditioner can function properly with this new gas.

THE EFFECTS OF HUMIDITY LEVELS AND TEMPERATURE ON THE DISTRIBUTION OF THE GENUS *ELEUTHERODACTYLUS* IN THE RURAL AREA OF CACAO IN THE MUNICIPALITY OF CAROLINA, PUERTO RICO

Frances Rodríguez, and Luis Rodríguez, La Piedad School, Carolina, Puerto Rico.

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Amphibians are vertebrate animals with the capacity of exploiting two different environments. Seventy-seven percent of the amphibians in Puerto Rico face survival problem, many as a result of climatic changes. This investigation sought to quantify the number of specimens of *Eleutherodactylus* in the rural area of Cacao, Carolina. This site borders the Yunque Rain Forest and is impacted by urban development. The study wanted to determine if humidity and temperature levels were factors that affect the amount and distribution of specimens of *Eleutherodactylus* in the area. The hypothesis was that a greater number of specimens were to be found in a temperature below 25°C and under 89% of relative humidity. A survey of specimens was performed in Cacao, Carolina and temperature and relative humidity levels were taken. The specimens found were classified by their respective species. The procedure was repeated three times. 53 % of the total of specimens were found in Quadrant #1, 44% in Quadrant # 2, and 3 % in Quadrant # 3. Sixty seven percent of these specimens were members of the *E. coqui*, 22% of *E. brittoni*, and 11% of the *E. antillensis*. All the specimens were found in temperatures and humidity levels below the established parameters.

ENGINEERING

EVALUATION AND PLACEMENT OF A MOVEMENT SENSOR CAPABLE OF CONTROLLING TRAFFIC

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The objective of this investigation was to develop a method to better control the flow of vehicles, contribute to fuel savings, and minimize the time that it takes to get from one location to another in Puerto Rico. The strategy used was to integrate a movement sensor to the traffic lights system in order to regulate vehicular flow. Tests were performed with the movement sensor to optimize the sensor installation, distance and measure effectiveness. Because the integration of the sensor to the traffic light system is systematic, the research focuses on the most accurate distance to install the sensor to be effective on the detection task.

DEVELOPMENT OF A STRATEGY TO REDUCE ACCIDENTS CAUSED BY DROWSINESS WHILE DRIVING A MOTOR VEHICLE

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Traffic accidents caused by drowsiness are one of the more important causes of death in modern society. This research focused on installing a device that could detect this behavior and alert the driver. Response time to input signals of lower than 1 second on an electric circuit in order to select the correct circuit for sensors input processing were evaluated. To accomplish the goal of the study, the circuits to be tested needed to be developed using a 9 volt Battery, Push bottom, Bread board, Electricity cable, DIP Switch, and Integrated Circuit.

ERGONOMIC DESIGN OF A SCHOOL DESK TO REDUCE BACKACHE

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Most of the school desks that are used today are not well designed. About 42% of the students younger than 11 years suffer from backaches because they spend too many hours seated in a school desk that is uncomfortable. This number increases up to 51% in the boys and 61% in the girls between ages 13 and 15. One of the problems is that the weight of the body is not proportional, and this creates tension between the muscles. If students are uncomfortable this could lead to bad posture, distraction, and poor academic performance. However a school desk with correct ergonomic features can prevent backaches, promote good posture and result in better performance. The objective of this investigation was to create a school desk with ergonomic features that would allow the body to have a good posture, reduce the risk of lesions and improve the process of learning. A school desk was designed and built taking into consideration that the weight of the person was proportional, the feet reached the floor, and the back was adjustable. The desk has an adjustable lumbar support that forms an angle between 90 to 110 degrees and the cushions were made out of High Density foam.

DETERMINATION OF THE PLACEMENT OF A WATER SENSOR TO REDUCE THE ENTRANCE OF WATER INTO THE INTERIOR OF A CAR

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Damages to car interiors as a result of rainfall have managed to be a serious problem for car owners. To solve this situation, an electric circuit can be integrated to water sensors to close the windows when rain is detected. The first step was to determine where the water enters first in an open window situation, in order to correctly locate and install the water sensors. This stage was conducted with an actual car. A hose was used to simulate rain. Small paper parts were located on the front, back and sides of the roof in order to detect rain. The procedure was recorded with a video camera to determine exactly which papers got wet. The test was made from different angles of the car and the results were clear. Depending on the car, atmospheric conditions and car velocity, the car would get wet in different areas. Based on the tests, a water sensor needs to be installed in the front, back and sides of the car in order to detect efficiently rain.

ROBOTICS SIMULATION IN A CONTROLLED ENVIRONMENT (ROAD INTERACTION)

Karlo E. Meléndez, Santa Mónica Academy, San Juan, Puerto Rico.

José R. Irizarry, Jorge A. Afanador, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

The goal of this project was to design a fully working program to direct a small autonomous vehicle along a series of obstacle courses using the Parallax Basic Stamp program. A series of sensors were used to aid the robot while running through the laps on the course. The “Sumobot” module was used as the autonomous vehicle for the investigation; this module uses a variety of QTI, infrared sensors as well as servo motors to detect obstacles in its path such as barriers and curves and/or where the road ends. This helps the vehicle adjust its course during movement. QTI sensors use a type of reflective infrared (IR) sensors that determine the reflectivity of the surface below it. The road the vehicle would be travelling was outlined with black electrical tape with a high reflective value when detected by the sensors. When the sensors detected this high reflective value, the program sent the vehicle the information needed to continue following its path. This investigation may be of much help in the development of systems and programs that could aid automobiles in the near future by detecting changes in the road, preventing accidents, and promoting better driving techniques.

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