UNIVERSIDAD METROPOLITANA (UMET)

IS PROUD TO HOST THE

SPRING 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
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Turabo University

SAN JUAN, PUERTO RICO

May 12, 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 and its sister institutions, Universidad del Este and Universidad del Turabo during the dissemination phase. NSF/AGMUS/MIE at offers a wide range of academic opportunities to science and engineering students from AGMUS. 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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Pre-College Students:

The Spring 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 January 2007, one hundred-twenty five 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 seven college professors and ten student research mentors in thirty-eight research projects in the areas of biological sciences, chemistry, applied physics, environmental science, engineering and atmospheric sciences.

One of the objectives of the Spring 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 Spring 2007 Saturday Academy Program and the Spring 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 Spring 2007 Saturday Academy Program and the Spring 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 to become 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 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.
The sponsorship of the National Science Foundation has been fundamental for the implementation of the Pre-College Program at Universidad Metropolitana (UMET). For eleven 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 extended to 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 level. The Saturday Academy Program usually extends for sixteen weeks during the months of January through May. 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. Today we are proud to include Universidad del Este and Universidad del Turabo as partners in this year’s Spring 2007 Pre-College Research Symposium.

The Spring 2007 Pre-College Research Symposium held at Universidad Metropolitana, on May 12, 2007, showcases the research experiences of one hundred twenty-five (125) pre-college students from forty high schools in Puerto Rico. Thirty-eight research projects are presented at the Symposium in the form of posters and oral presentations. The mentorship of seventeen 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. This year eight projects developed at public and privates high school of the educational system of Puerto Rico are presented in poster format.

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 Spring 2007 participants. We hope this Symposium will be a vehicle by which the scientific productivity of high school students from Puerto Rico will be disseminated in future years.
KEYNOTE SPEAKER

Lucy Hamilton, Ph. D. Candidate
University of California-Los Angeles

Lucy Hamilton was born in San Juan, Puerto Rico. She studied at Cupeyville School, in San Juan, while she lived in Caguas. Ms. Hamilton studied as an undergraduate at Universidad Metropolitana (UMET) in San Juan, Puerto Rico, where she completed a Bachelor’s in Science in Cellular Molecular Biology in 2004. She is now in the Ph.D Program, Pathology Department, at the University of California in Los Angeles. While at UMET, Ms. Hamilton was part of the Excellence List several times. She conducted research in the summer of 2000 at Towson University in Maryland on tree swallows to study and determine the sex of their offspring. She presented this research at the University of Texas at El Paso in 2001. She also conducted research at Universidad Metropolitana, Investigation of the Fluoridation of Water in Puerto Rico, which she presented at the 2001 Spring Undergraduate Research Symposium at UMET. In the summer of 2001, she conducted research at the University of California at Los Angeles (UCLA), Unglycosylated Kv1.6 Potassium Channel Protein is Degraded by Cytoplasmic Proteasomes that she presented at the University of Texas at El Paso at the 6th Annual MIE Conference and at UCLA in 2001. In March of 2002, she presented this research at the 59th Joint Annual Meeting of the National Institute of Science, and won second place in oral presentations. In the summer of 2002, she returned to the University of California at Los Angeles to continue her previous research. She presented it at the XIII Undergraduate Research Symposium held at Universidad Metropolitana in October 2002, at the Annual Biomedical Research Conference for Minority Students, held in New Orleans, Louisiana, in November 2002, and at the California Alliance for Minority Participation (CAMP) Symposium V held in February 2003 in California. She won first place for her oral presentation in this last symposium. As an undergraduate, Lucy Hamilton is an example of a MIE scholar who took advantage of all the opportunities provided by the Model Institutions for Excellence project while she was a student at Universidad Metropolitana.
SCHEDULE OF EVENTS

SATURDAY, MAY 12, 2007
THEATER, UNIVERSIDAD METROPOLITANA

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: Ms. Lucy Hamilton, Ph.D. Candidate
University of California-Los Angeles

8:30 – 10:00 a.m.
POSTER SESSION
MORALES CARRIÓN BUILDING

BIOLOGY
CHEMISTRY
APPLIED PHYSICS
ENVIRONMENTAL SCIENCES
ENGINEERING
ATMOSPHERIC SCIENCES

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

BIOLOGY

Shampiere Casillas, Antilles Military Academy, Trujillo Alto, Puerto Rico. (1)
Raquel Castañeda, María Auxiliadora School, San Juan, Puerto Rico.
Sulyvette Díaz, Nuestra Señora de Lourdes School, Carolina, Puerto Rico.

Characterization of the Oncogene Her-2/Neu and the Tumor Growth Factor Beta Receptor 1 (TGFβRI) in Squamous Cell Carcinoma Cell Lines

Miguel A. Rivas, Stephanie M. Vega, Carvin School, Carolina, Puerto Rico. (2)
Liris N. González, María Auxiliadora School, San Juan, Puerto Rico.

The Effect of Vitamins in the Expression Levels of Her 2/Neu in the Colon Squamous Carcinoma Cell Line Lovo
Wilfredo Morales, Rexville High School, Bayamón, Puerto Rico. (3)

Dae Jin Ko Shin, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

Erika Vargas, Carvin School, Carolina, Puerto Rico.

The Effect of Vitamins in the Expression Levels of Her 2/Neu in the Human Epithelial Carcinoma Cell Line A431

Emmanuel Villanueva, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico. (4)

Damelvis Paredes, University Gardens High School, San Juan, Puerto Rico.

Identification of Genomic Deletions in P15INK4B, P16INK4A and P14ARF Tumor Suppressor Genes in Human Cell Lines

Jean Peña, Mariela Rivera, San Vicente de Paúl School, San Juan, Puerto Rico. (5)

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

Identification of Genomic Alterations in the Metalloproteinases MMP2 and MMP9 in Human Carcinoma Cell Lines

Sebastián G. Molina, San Vicente de Paúl School, San Juan, Puerto Rico. (6)

Karoline Ríos, Edgardo Amador, Ramón Vila Mayo High School, San Juan, Puerto Rico.

The In vitro Effect of Vitamin B12, Vitamin C and Vitamin E in the Proliferation of Human Colon Adecarcinoma, and Tongue Squamous Cell Carcinoma Cell Lines

Gustavo Muller, Lianny De Jesús, and Karilys Ortiz, María Auxiliadora School, Carolina, Puerto Rico. (7)

Vitamin as Regulator of the mRNA Expression Levels of DE P16INK4A TβRI and MMP9 in the Human Carcinoma Cell Lines A431
José A. Santiago, María Auxiliadora School, San Juan, Puerto Rico. (8)

Retinoic Acid (RA) as Modulator in of VEGF in Oral Squamous Carcinoma Cells Line CAL 27 and Adenoma Colon Carcinoma Cell Line Lovo

Edwin López, José M. Rodríguez, María Auxiliadora School, San Juan, Puerto Rico. (9)

Is Retinoic Acid a Regulator of the MRNA Expression of the Metastasis Related Molecules: VEGF-Receptor and MMP9?

Lismar Collado, Radians School, Cayey, Puerto Rico. (10)

Effects of the Homeopathic Tonic “Palito de Navidad” on the Growth of Human-Saliva Related Bacteria

Johann Martínez, Radians School, Cayey, Puerto Rico. (11)

Permeability to Oxygen as a Two-Point Source of Error in Simple Management Protocols

Sheydanis Díaz, Radians School, Cayey, Puerto Rico. (12)

The Colonization of Caracolus caracolla Feces by Microorganisms: A Descriptive Study

Abdiel Ortiz, Radians School, Cayey, Puerto Rico. (13)

Physical Parameters Related to Seed Selection for the Comercial Cultura of the Papaya Tree (Carica papaya)
CHEMISTRY

Michael Rosario, Federico Asenjo School, San Juan, Puerto Rico. (14)
Víctor Correa, Inmaculada Concepción School, San Juan, Puerto Rico.
Nancy E. Blanco, St. Mary’s School, San Juan, Puerto Rico.
Yea Jin Ko Sin and Carlos A. Pérez, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.

Green Power Fuel for Global Warming

APPLIED PHYSICS

Edwin Ortiz, Jesús M. Candelario, República de Costa Rica High School, Caguas, Puerto Rico. (15)
César Mójica, Corazón de María School, Juncos, Puerto Rico.
Luis A. López, Florencia García High School, Juncos, Puerto Rico.

LED Light Bulb

Adamaría Franco, Karla T. Franco, Thomas A. Edison High School, Caguas, Puerto Rico. (16)
Melanie Ortiz, Notre Dame Catholic School, Caguas, Puerto Rico.

Index of Refraction from Various Points Around the Island’s Coast of Puerto Rico

ENVIRONMENTAL SCIENCES

Katherine Ruíz, Radians School, Cayey, Puerto Rico. (17)

Heavy Metal Pollution in Ecologically and Culturally Important Rivers in Puerto Rico

Juliana Rivera, Ninoshka Bernabé, Alexis M. Oquendo, Felipe Rivera Centeno School, Caguas, Puerto Rico. (18)

Comparison of Fungal Growth in Relation with Various Humidity Parameters in Fiberglass
Natalie A. Miranda, José G. Cruz, Manuela Toro Morice  (19)
High School, Caguas, Puerto Rico.
Emmanuel Meléndez, Antonio S. Pedreira High School,
Caguas, Puerto Rico.

Relation Between Fungal Growth and Humidity Parameters in Concrete

Gabriel Sotero, Bautista de Carolina Academy, Carolina,  (20)
Puerto Rico.
Hevayliz Vega, María Auxiliadora School, Carolina, Puerto Rico.

Air Temperature Fluctuation Effects on Growth and Development of *Lactuca sativa L*

Lhyell M. Baerga, Wilmarie Marrero, and Yesenia  (21)
Pitre, María Auxiliadora School, Carolina, Puerto Rico.

The Effects of Acid Rain on the Growth and Development of *Lactuca sativa L*

Alejandra Figueroa, Kiana Ríos, Héctor Encarnación,  (22)
and Ana Maris Canales, Ángel P. Millán High School,
Carolina, Puerto Rico.

The Effects of Wet and Dry Tropical Climates on the Behavior of the *Acheta domesticus*

Emely Morales, Sairymar Suárez, and Anthony Llanes,  (23)
Del Carmen Academy, Carolina, Puerto Rico.

Studies of pH Levels of Water Simples Taken from Streams in the Municipalities of Carolina and Trujillo Alto

Armando A. Ledesma, María Auxiliadora School,  (24)
Carolina, Puerto Rico.
Selimar Ledesma and Germaine Peña, Luis Hermaiz
Veronne High School, Canóvanas, Puerto Rico.
Héctor M. Rolón, Del Carmen Academy, Carolina, Puerto Rico.

Biodiversity Limitations in the UNE Wetland
Valerie M. Quiñones, Yelian Garay, José A. Garay, and Darryl J. Oquendo, Del Carmen Academy, Carolina, Puerto Rico.

The Potential of Wetlands as Heat Absorbers

Gissel De la Rosa, Melanie Gómez, Valerie Gómez, and Verónica González, Antonio Barriera High School, Carolina, Puerto Rico.

Quality of Wetland Waters

ENGINEERING

José González-Goitía, Abner J. Hernández, Dr. María Cadilla High School, Arecibo, Puerto Rico.

The Effectiveness of the AJ Condenser

ATMOSPHERIC SCIENCES

Charles A. Lozada, Ramón Power & Giralt High School, Las Piedras, Puerto Rico.

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<td>Chairperson: Dr. Teresa Lipsett&lt;br&gt;MIE Co-PI Turabo University</td>
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<td>BIOLOGY</td>
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<td><strong>Zoreli Rivera</strong>, Bilingüe Padre Rufo School, San Juan, Puerto Rico.&lt;br&gt;<strong>Germán L. Vélez</strong>, Adianez School, Guaynabo, Puerto Rico.</td>
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<td>Differences in the Effects of Vitamin E, B12 and C in the Expression Levels of the Her 2/Neu Gene in Human Squamous Carcinoma Cell Line A431 and Lovo</td>
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<td>Vitamin E Intake and the MRNA Expression Levels of P16INK4A, Tβ and MMP9 in the Human Adenoma Carcinoma Cell Line Lovo</td>
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<td><strong>Ángel L. Pagán</strong>, Lourdes School, San Juan, Puerto Rico.&lt;br&gt;Jannissely Quiles, Ramón Vila Mayo High School, San Juan, Puerto Rico.&lt;br&gt;<strong>Carol S. Vélez</strong>, Episcopal Cathedral School, San Juan, Puerto Rico.</td>
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<td>Potential Victims of the Reproductive Parasitism of the Shiny Cowbird in the Community of Birds of Piñones Forest</td>
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10:40 – 10:50 a.m. Ariana J. Rodríguez, Cristina L. Rivera, Elimar Rodríguez, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico. Ángel G. Rivera, Rexville High School, Bayamón, Puerto Rico.

Spring Censuses of Bird Community from Martín Peña Canal, San Juan, Puerto Rico

10:50 – 11:00 a.m. Edwin J. Ferrer, Francisco Morales High School, Naranjito, Puerto Rico.

The Use of Garlic Fungicide Agent

CHEMISTRY

11:00 – 11:10 a.m. Asaria Jiménez, Lukas G. Colberg and Stephanie Ros, St. Mary’s School, San Juan, Puerto Rico.

Biodiesel: Cultivating Alternative Fuels

ENVIRONMENTAL SCIENCES


Comparison of Fungal Growth in Relation with Various Humidity Parameters in Unprotected Plywood

ENGINEERING


Simulation of Robots in an Industrial Environment

11:30 – 11:40 a.m. Eduardo Alvarez, Menonita Academy, San Juan, Puerto Rico. Russel Correa, Gabriela Mistral High School, San Juan, Puerto Rico.

Building and Programming a Robotic Arm for the Use of Surgical Procedures
11:40 – 11:50  Henry Rodríguez, Michael Maymí, Thomas A. Edison High School, Caguas, Puerto Rico.

Transformer

11:50 – 12:50  AWARD CEREMONY AND CLOSING REMARKS
12:50 – 1:30 p.m.  BRUNCH
1:30 p.m.  SYMPOSIUM ADJOURNS
ABSTRACTS

BIOLOGICAL SCIENCES

CHARACTERIZATION OF THE ONCOGENE HER-2/NEU AND THE TUMOR GROWTH FACTOR BETA RECEPTOR I (TGFβRI) IN SQUAMOUS CELL CARCINOMA CELL LINES

Shampiere Casillas, Antilles Military Academy, Trujillo Alto, Puerto Rico.
Raquel Castañeda, María Auxiliadora School, San Juan, Puerto Rico.
Sulyvette Díaz, Nuestra Señora de Lourdes School, Carolina, Puerto Rico.

Research Mentor: Sharon Fonseca, Medical Sciences, University of Puerto Rico, San Juan, Puerto Rico.

HER2/neu (ErbB-2) is a member of the epidermal growth factor receptor (ErbB) family and its role in the pathogenesis of breast cancer have been extensively studied. HER2/neu is involved in the signal transduction pathways leading to cell growth and differentiation. Overexpression of this receptor has been reported mainly in breast cancer, but also in ovarian cancer and stomach cancer. Tumor growth factor beta (TGF-β) regulates growth and proliferation of cells, blocking the growth of many different cell types. The TGF-β receptor includes type I and II that signal through the Smad family of proteins. The Smads complex once activated recruits other transcription factors activating the expression of target genes, some that stimulate tumorigenesis, others suppress tumorigenesis. The purpose of this project was to detect the presence of HER-2/neu and TGFβ receptor type I in oral cavity, colon and cervix squamous carcinoma cell lines (SCCLs) and evaluate if there are genomic deletions among these SCCLs. After DNA extraction from A431 (cervix SCCL), LoVo (colon SCCL) and CRL2095 (oral cavity SCCL), a PCR was performed with primers specific to amplify the genes HER/neu and TGFβ receptor type I. The presence of the target genes was positively detected in all SCCLs; however, the density of TGFβ type were lower in the cervix squamous cell carcinoma compared with colon and oral cavity squamous cell carcinoma cell lines. Further studies will be performed to detect the expression of these growth factors.
THE EFFECT OF VITAMINS IN THE EXPRESSION LEVELS OF HER 2/NEU IN THE COLON SQUAMOUS CARCINOMA CELL LINE LOVO

Miguel A. Rivas, Stephanie M. Vega, Carvin School, Carolina, Puerto Rico.
Liris N. González, María Auxiliadora School, San Juan, Puerto Rico.

Research Mentor: Sharon Fonseca, Medical Sciences, University of Puerto Rico, San Juan, Puerto Rico.

Vitamin E (Vit E) is a liposoluble vitamin and is a natural antioxidant which reacts with free soluble radicals in membrane lipids. Vitamin E deficiencies may due to the impairment of fat absorption, and it may have serious effects on cellular proliferation and phagocitosis. On other hand, vitamin B12 (Vit B12) is essential for the red blood cell and DNA production. In addition, Vit B12 has a key role in the maintenance of the central nervous system. The effect of Vit B12 on the proliferation of malignant cells has been examined. Finally, Vitamin C (Vit C), a potent antioxidant, is also an important modulator for the immune, metabolic, endocrine and neurological functions, and a requirement for the synthesis of collagen and other tissues. However, the effects of this Vitamin on cancer are a controversy. This project examined the effects of Vitamin E, B12 and C on the expression of the HER2 (also called erb2) a gene involved in the growth and proliferation of certain cancer cells. After RNA extraction from LoVo cells, an RT PCR was performed to produce DNA copies (cDNA) of the RNA template. Later a PCR was performed using primers specific for HER2 to examine the expression of this gene in control and treated LoVo cells. A lower HER2 was observed in cells treated with vitamin E and C for 72 hours, particularly for Vit E when compared with the expression of HER2 in the control cells. The expression of Her2/neu in LoVo cells treated with B12 was slightly overexpressed when compared with control cells. Further studies will be performed to examine the effect of these vitamins in the expression of HER2 in a different squamous carcinoma cell line.

THE EFFECT OF VITAMINS IN THE EXPRESSION LEVELS OF HER 2/NEU IN THE HUMAN EPITHELIAL CARCINOMA CELL LINE A431

Wilfredo Morales, Rexville High School, Bayamón, Puerto Rico.
Dae Jin Ko Shin, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.
Erika Vargas, Carvin School, Carolina, Puerto Rico.

Research Mentor: Sharon Fonseca, Medical Sciences, University of Puerto Rico, San Juan, Puerto Rico.

Vitamin B12 (Vit B12) is essential for red blood cell and DNA production and has a key role in the maintenance of the central nervous system. The effect of Vit B12 on the proliferation of malignant cells has been examined. In animal studies, Vit B12 suppressed the tumor growth of cancer cells in mice fed a vitamin B12 deficient diet suggesting that this vitamin might inhibit the proliferation of malignant cells in culture and in vivo. On the other hand, Vitamin E (Vit E) is a liposoluble vitamin and is a natural antioxidant which reacts with free soluble radicals in membrane lipids. Vitamin E deficiencies may be due to the impairment of fat absorption, but it also has serious effects in cellular proliferation. In this project, the effects of vitamin B12 and E were examined in the expression of HER2, a gene involved in the growth and proliferation of certain cancer cells. After RNA extraction from A431 cells, an RT PCR was performed to produce DNA copies (cDNA) of the RNA template. Later, a PCR was performed using primers specific for HER2 to examine the expression of this gene in control and treated A431 cells. The expression of HER2 was not detected in control cells, neither in cells treated with Vit E. However, an induction in the expression of HER2 in cells treated with vitamin B12 for 72 hours was observed. Further studies will be performed to examine the effect of these vitamins in the expression of HER2 in a different squamous carcinoma cell lines.
DIFFERENCES IN THE EFFECTS OF VITAMIN E, B12 AND C IN THE EXPRESSION LEVELS OF THE HER 2/NEU GENE IN HUMAN SQUAMOUS CARCINOMA CELL LINE A431 AND LOVO

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The role of the vitamins and antioxidants in cancer treatment and prevention have been extensively studied. Vitamin E (Vit E) is a liposoluble vitamin and is a natural antioxidant which reacts with free soluble radicals in membrane lipids. Vitamin B12 (Vit B12) is essential for the red blood cells and DNA production and has an essential role in the maintenance of the central nervous system. In animal studies, large doses of Vit B12 suppressed the tumor growth of cancer cells demonstrating the inhibition in the proliferation of malignant cells in culture and in vivo. Hydrogen peroxide (H₂O₂), a tumor promoter, inhibits Gap-junction intercellular communication (GJIC) which is essential for maintaining normal cell growth. Vitamin C (Vit C), a potent antioxidant, reduces or prevents oxidation, thus it is necessary to prevent the inhibition of GJIC induced by H₂O₂. However the effects of vitamin C on cancer are a controversy. Studies performed at Cornell University reported that vitamin C blocks the carcinogenic effects of H₂O₂ on intercellular communication. On the other hand, studies performed at the Sloan-Kettering Memorial Cancer Center reported that supplemental vitamin C may be harmful to cancer patients. HER2/neu is involved in the signal transduction pathways leading to cell growth and differentiation. In order to examine the effects of Vit E, B12 and C in the expression of HER2/neu in the human squamous carcinoma cell lines (SCCLs) A431 and LoVo, the SCCLs were treated with these vitamins for 72 hours. After RNA extraction from A431 and LoVo cells, an RT PCR was performed to produce DNA copies (cDNA) of the RNA template. Later a PCR was performed using primers specific for HER2 to examine the expression of this gene in control and treated A431 and LoVo cells. In control cells, the expression of HER2/neu was detected in the colon SCCL LoVo. In A431 control cells, the expression of HER2/neu was undetected. Similar results were observed in cells treated with Vit E where the expression of HER2/neu was detected in LoVo, but not in A431 cells, although underexpressed when compared with LoVo control cells. The expression of HER2/neu was detected in both SCCL treated with Vit B12 and the overexpression was observed in LoVo cells when compared with the results for A431 cells treated with the same vitamin. The effects of Vit C were only successfully detected for LoVo cells where underexpression was observed if the results of the treated and the control cells are compared.
IDENTIFICATION OF GENOMIC DELETIONS IN P15INK4B, P16INK4A AND P14ARF TUMOR SUPPRESSOR GENES IN HUMAN CELL LINES

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The INK4-ARF locus at chromosome 9p21-22 is frequently altered in human tumors. Dysregulation of the normal cell cycle regulatory machinery is integral to the neoplastic process and there is now compelling evidence implicating loss of cell cycle control in the development and progression of most human cancers. Consequently, cell cycle regulatory molecules are attractive potential prognostic markers. The INK4-ARF locus is frequently disrupted in human cancers and consists of three genes p15INK4B and the two overlapping genes p16INK4A and p14ARF. The proteins encoded by these genes act to regulate cell cycle progression, and these important oncogenic pathways are frequently dysregulated in human cancer. This study addressed identified genomic deletions several hot spot regions of the tumor suppressor genes p15INK4B, p16INK4A and p14ARF. The polymerase chain reaction was employed to detect the presence of deletions in p15INK4B, p16INK4A and p14ARF. A431 cell lines showed deletions in p15INK4B, and p14ARF genes. The CRL2095 exhibited deletion in p15INK4B exon 2. On the other hand, deletion of p15INK4B, p16INK4A and p14ARF was not detected in LoVo cell lines. p15INK4B, p16INK4A and p14ARF could have a role as potential prognostic markers in this disease. The identification of prognostic markers with potential clinical utility may assist in clinical management and suggest new targets for therapy, as well as provide insights relevant to a better understanding of the biology of cancer.

IDENTIFICATIONS OF GENOMIC ALTERATIONS IN THE METALLOPROTEINASES MMP2 AND MMP9 IN HUMAN CARCINOMAS CELL LINES

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The metalloproteinases (MMP-s) are a family of endopeptidases implicated in the degradation of extra cellular matrix. They are associated with migration and development of human tissue. However, the MMP-s family is also related with malignant transformation processes such as tumor invasion and metastasis in cancer. According to Yang, both metalloproteinases contribute to the aggressiveness of these tumors. "It isn’t clear exactly how they are operating, but they may work with vascular endothelial growth factor (VEGF) to facilitate blood vessel growth in new tumors so that they can grow." To clarify which MMP-s are required for metastasis events, the polymerase chain reaction (PCR) was used to identify genomic alterations in the MMP-2 and MMP-9 genes, in three different human carcinoma cell lines. The samples were human carcinoma cell lines with different degrees of tumorigenic rate. The tongue squamous cell carcinoma (Cal 27) could develop solid tumors developed within 6 weeks in nude mice inoculated with 2 x 10^6 cells subcutaneously. A431, a vulva carcinoma, forms rapidly growing subcutaneous tumors in immunosuppressed mice and colonies in soft agar. The highly tumorigenic colon adenoma LoVo can develop tumors within 21 days at 100% frequency (5/5) in nude mice inoculated subcutaneously with 10^7 cells. The PCR analyses did not show deletion in both metalloproteinases genes. The results, suggest that both metalloproteinases MMP2 and MMP2 are required for tumor cells migration and invasion.
THE IN VITRO EFFECT OF VITAMIN B12, VITAMIN C AND VITAMIN E IN THE PROLIFERATION OF HUMAN COLON ADECARCINOMA, AND TONGUE SQUAMOUS CELL CARCINOMA CELL LINES

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The aim of the present study was to evaluate the effect of vitamin B12 and the antioxidants vitamin C and vitamin E in the proliferation of a colon adenocarcinoma (LoVo), and a tongue squamous cell carcinoma cell line (Cal 27). Epidemiological studies have suggested an anticancer activity of the antioxidants E and C in U. S. diets. The action of these vitamins on the tumor cell proliferation in vitro was investigated. Both cell lines to 0.1µm vitamin E, 15nM vitamin B12 and 10µM vitamin C make a growth curve vs. control RPMI-1640 serum free media. It was found that vitamin E and vitamin B12 exhibit the strongest proliferation inhibition in LoVo cell lines; however, the other antioxidant vitamin C did not show any effect over the cell proliferation in the LoVo cell line. The Cal 27 growth was not severely affected by vitamin treatment. A genuine change in proliferation rate in Cal 27 exposed to vitamins and antioxidants was not detected. These results suggest that vitamins B12 and the antioxidant vitamin E could be used to reduce the colorectal tumor progression.

VITAMIN E INTAKE AND THE MRNA EXPRESSION LEVELS OF P16INK4A, TßRI AND MMP9 IN THE HUMAN ADENOMA CARCINOMA CELL LINE LOVO

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Experimental studies suggest that tocotrienol (vitamins E) and minerals protect against cancer by reducing proliferation and inducing differentiation in various cell cultures including colon-derive cells as well as in experimental animal studies. In addition, vitamin E preserves renal function and reduces free radicals, vasoconstrictive thromboxanes, and tubulointerstitial fibrosis. Studies with rats with high doses of vitamin E showed mRNA inhibition in hemeoxygenase I, TGF-ß and osteopontin. Moreover, recent studies suggest that vitamin E induces apoptosis in colorectal tumor cell lines and premalignant adenoma cell lines. Several mechanisms have been proposed to explain how vitamin E compounds might produce beneficial protective effects in cancer have been postulated, including the following: inhibition of cancer formation by the quenching of free radicals; direct effects on tumor cells such as control of tumor growth through induction of differentiation; cell cycle inhibition or induction of apoptosis; and elimination of tumor cells by increased efficacy of antitumor actions by the immune system. The human colon adenoma cell line LoVo to 0.1µm vitamin E was exposed to determine the role of this antioxidant LoVo for 72 hrs to determine the role of vitamin E as modulator of the mRNA expression levels of the transforming growth factor receptor I (TßRI) and downstream the tumor suppressor gene p16INK4A. Also, the mRNA expression levels of the metalloproteinase MMP9 were tested which is essential for metastasis evolution. The RT-PCR analysis showed that vitamin E induced the expression of the TßRI; however, it acts as down regulator of p16INK4A and MMP9 gene expression. The results suggest a possible role of vitamin E in the development and progression of the disease.
Abnormalities of epithelial proliferation have been proposed as an early step in carcinogenesis. To determine whether micronutrient supplementation may reduce squamous epithelial proliferation, proliferation in epithelial vulva human squamous carcinoma cell line A431 exposed to vitamin B12 and the antioxidant vitamin vitamin E were evaluated. To further test the effect of vitamins, the effect of vitamin B12, vitamin C and vitamin E in the expression of some key molecules associated with cancer initiation, and progression were analyzed. The RT-PCR assay was employed to determine the mRNA expression levels of the transforming growth factor receptor gene (TßRI) downstream effectors p16INK4A, and the metalloproteinase MMP9 which is involved in metastasis events. The results showed that vitamin B12 strongly inhibits the mRNA expression of the tumor suppressor gene p16INK4A, and the antioxidant vitamin E inhibits the expression of TßRI. The treatments did not affect the expression of the MMP9, it could suggest that vitamin E and vitamin B12 have an effect on the early stages of the tumors.

EFFECTS OF THE HOMEOPATHIC TONIC “PALITO DE NAVIDAD” ON THE GROWTH OF HUMAN-SALIVA RELATED BACTERIA

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Humans are susceptible to bacteria and to many other microorganisms that may cause diseases. As a result, many plants have been identified as possible treatments for a variety of diseases. In the rural part of Puerto Rico, a homemade, homeopathic tonic known as “Palito de Navidad” has been used to treat sore throat. The tonic is a mix of clove spice, cinnamon, aloe vera, anise, honey, and rum. The research conducted was to investigate whether the “Palito de Navidad” tonic was a feasible treatment for sore throat. To do this, fresh-saliva samples were plated in- and without the presence of “Palito de Navidad”. Data for further analysis was collected after 24- and 48-hr after the saliva was plated. At both times, in all three samples treated with Palito de Navidad, a considerably amount of bacterial growth was observed. Surprisingly, when compared to the saliva-only control, the plates treated with “Palito de Navidad” apparently had a higher magnitude of bacterial colonies. Although no anti-bacterial effect was found in the “Palito de Navidad”, many people in Puerto Rico stated that the use of the tonic relieves and cures them from microorganism-caused throat infections. The higher amount of bacteria colonies present in the sample treated with “Palito de Navidad” when compared to saliva-only plates not only demonstrates that the tonic is non-effective against bacteria growth, but does the opposite, it produces bacteria proliferation. Finally, it is known that throat related diseases may also be caused by many other microorganisms such as viruses and protozoa, among many others. Because these other variables were not studied during the experiment, the possibility that the tonic “Palito de Navidad” may be effective against other microorganisms has not been studied.
PERMEABILITY TO OXYGEN AS A TWO-POINT SOURCE OF ERROR IN SAMPLE MANAGEMENT PROTOCOLS

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Precise measurement of oxygen levels is necessary for water quality assessment in a broad range of scenarios, from ecological studies to governmental regulations and compliance. Permeability to exogenous oxygen could be a source of error from two points of view; firstly, by changing the actual concentration of oxygen in the sample; secondly, by changing the concentration of oxygen in the standards used when the sensing instruments are calibrated. The guide question for this study is: Are sampling- and storage-protocols subject to errors due to oxygen permeability? To address this problem, anoxic environments were created using a small and a large anaerobic dry box. Different combinations of storage jars or cell plates were sealed following standard anoxic-protocols. Jars were sealed by using Teflon-, or electric-tape, wax, polypropylene film, parafilm, and stored in triple jars. Cell plates were sealed with thick or thin Kapton tape. Permeability to Oxygen was assessed using reduced forms of methylviologen and indigo carmine as indicators. The results showed that contrary to the general assumption, double jars sealed with single Teflon tape or polypropylene film stayed anaerobic only for a couple of hours. In respect to the cell plates, surprisingly, samples sealed with thin- or thick-Kapton tape were able to be stored for hours, contrary to the plates sealed with polypropylene film. The order of oxygen permeability was: polypropylene film (1-2 hr) << thin- = thick-Kapton tape (24 hrs). Thus, for overnight shipping and long term storage, jars need to be sealed with wax, covered first with electric tape, then with parafilm, and stored in triple jars. In addition, cell plates need to be sealed with thin- or thick-Kapton tape. The impact to other areas in which critical assessment of oxygen levels is required is also discussed.
THE COLONIZATION OF *CARACOLUS CARACOLLA* FECES BY MICROORGANISMS: A DESCRIPTIVE STUDY

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Bacteria, protozoa, fungi, and other microorganisms play an important role in the decomposition process of organic and inorganic matter in the environment. This process is vital for wildlife and microorganism survival. Therefore, in order to better understand this process in the snail, colonization by bacteria in *Caracolus caracolla* feces were studied. Three *C. caracolla* snails were randomly collected from the Carite forest and properly placed in clean individual fish tanks. Feces samples were collected at an initial time 0 hr, after 12-, and 24-hr from each snail. After collecting the samples, they were processed for bacteria identification and quantification. The study showed bacterial levels to be above 100,000 col/mL at all times measured and gram-negative. However, not all bacterial species found were present during the same time period. Bacterial species found in the feces from the entire *C. caracolla* specimens studied at time 0 hr included: *Escherichia hermannii*, *Enterobacter intermedius*, *Kluyvera* species, and *Klebsiella pneumoniae*; at 12 hr: *Escherichia hermannii*, *Enterobacter intermedius*, *Kluyvera* species, *Klebsiella pneumoniae* and *Citrobacter freundii*; at 24 hr: *Citrobacter freundii*, *Enterobacter cloacae*, *Citrobacter freundii*, and *Enterobacter intermedius*. The two most common type of bacteria found throughout the experiment were *Enterobacter intermedius* and *Citrobacter freundii*. In addition, they were tested to find out if the total bacterial species found for each snail was any different from the other two snails. Using a Two-way ANOVA, no difference was found between the different species of bacteria present in all samples (α = 0.05, F= 0.218, F crit = 4.10, and p > 0.05). Thus, suggesting that these bacteria might be part of the common bacterial flora present in *C. caracolla*. Furthermore, the observation that bacteria appear at different times suggest that the bacteria that began the decomposition process inside the snail intestine will allow other microorganisms to continue freely with the process. Perhaps, this demonstrates the process of ecological succession, which occurs daily in the environment.

THE USE OF GARLIC FUNGICIDE AGENT

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The aim of the present investigation was to determine if the use of garlic as a fungicide agent can control the different types of fungi cultivated in agar sabureau plaques. To achieve this, a garlic extract was created to apply it in different inoculated plaques to obtain a pure culture and the effects of the garlic as a fungicide agent were observed. After applying, it was left to settle for 48 hours and 6 minutes. Photos were taken of the process. The results revealed that the hypothesis was true. Garlic has a substance which can control many types of fungi that grow on the plaques of agar sabureau. The use of garlic as a fungicide agent can control different types of fungi in the environment cultivated in plaques with agar sabureau. Future research can be made with different types of patogenous fungi that grow in the human body to create a natural medicine.
PHYSICAL PARAMETERS RELATED TO SEED SELECTION FOR THE COMMERCIAL CULTURE OF THE PAPAYA TREE (CARICA PAPAYA)

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Papaya is an important agricultural product around the world due to its extensive traditional and commercial use. A limiting factor for the growers is the relatively long germination period combined to the possibility that after waiting from 6 to 10 months for the trees to bloom, part of the plants turn out to be masculine unproductive. The driving question for this research is whether there are a set of characteristics in the seeds that would allow growers to anticipate their reproductive success as determined by its germination rate, its post-germination growth rate and the sex ratios. To address this question, papaya fruits were chosen at random, split, and each seed was mapped using a grid. Seeds were randomly taken representing different sectors of the fruit and were taken to the lab to determine their volume, mass, density and diameter. All seeds were planted under the same conditions and followed in growth up to the present. The results showed that the mean diameter of the seeds was 6.63 mm (+/- 0.80), the mean volume was 1.36 cc (+/- 0.50), the mean density was 0.15 gm/cc (+/- 0.04), and the mean mass was 0.2 gm (+/- 0.06). The mean germination span was 21 days (+/- 1.84), and the mean post germination rate was 0.77 cm/day (+/- 0.16). No statistically significant correlations were found, but a strong pattern was observed between seed volume and germination span (t = 0.66; p >.05), between seed mass and post germination growth rate (t = 0.44; p >.05) and between seed density and post germination growth rate (t = 0.84; p >.05). It is recommended that growers screen their seeds for the ones having less volume to get shorter germination spans and for the ones with greater mass or density to get faster post germination growth rates.

RETINOIC ACID (RA) AS MODULATOR IN OF VEGF IN ORAL SQUAMOUS CARCINOMA CELLS LINE CAL 27 AND ADENOMA COLON CARCINOMA CELL LINE LOVO

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Angiogenesis, the formation of new vessels from preexisting ones, is a vital function for the cell to obtain nutrients, oxygen and for normal embryonic development. This process is regulated by pro- and anti-angiogenic factors such as the Vascular Endothelial Growth Factor (VEGF). VEGF has been linked with different processes of angiogenesis such as vasodilatation and increased f permeability. After this, proliferation and migration of endothelial cells are the final steps of angiogenesis forming the new vessels. Metastasis, one of the worst and most known features of cancer, is thought to be mediated by this process. Inhibition of metastasis is now being studied as a possible biomedical treatment for anti-drug cancer. Previous studies had demonstrated that retinoic acid (RA), a metabolic form of vitamin A, and some of its synthetic derivates (retinoids) can inhibit tumor cell proliferation and induce cell differentiation. Nevertheless, this molecular mechanism is still unclear. The hypothesis of this study suggests that RA modulates the inhibition of VEGF gene expression. In this study, the presence of genomic alterations in the VEGF gene was scrutinized. The integrity of the treatment was established After establishing the integrity of the VEGF gene, the adenocarcinoma colon cell line (LoVo) and oral squamous cell carcinoma (Cal 27) to Cis-Retinoic (10 µM and 50µM) and All-Trans-Retinoic (10 µM and 50µM) for 72hr were verified. After treatment, total RNA was isolated and analyzed by RT-PCR assay. The results revealed that 50µM Cis-RA or ATRA induce the expression of mRNA VEGF on LoVo human cell lines.
IS RETINOIC ACID A REGULATOR OF THE MRNA EXPRESSION OF THE METASTASIS RELATED MOLECULES: VEGF-RECEPTOR AND MMP9?

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Several studies have revealed that retinoic acid and some of its synthetic derivatives (retinoid) are useful pharmacological agents in cancer chemotherapy and cancer prevention treatments. Studies show that retinoid acid inhibits the growth of many human tumor cells. However, the exact molecular mechanism of retinoid-mediated growth suppression remains unknown. The evolution of any tumor is essential in the growth of blood vessels from pre-existing vasculature growth or angiogenesis. The vascular endothelial growth factor (VEGF) is an important signaling protein involved in both: vasculogenesis (the de novo formation of the embryonic circulatory system) and angiogenesis. As its name implies, VEGF activity is restricted mainly to cells of the vascular endothelium, although it does have effects on a limited number of other cell types. Moreover, in vitro, VEGF has been shown to stimulate endothelial cell mitogenesis and cell migration. VEGF also enhances microvascular permeability and is sometimes referred to as vascular permeability factor. Angiogenesis requires the action constituted by the family of enzymes from the group of proteinases, classified by the nature of the most prominent functional group in their active site. Metalloproteinases (MMPs) are zinc-dependent endopeptidases, which degrade the endothelial cell basement membrane for the migration process. A human head and neck squamous cell line was used to determine the effect of the exposure to Cis-Retinoic (10 µM and 50µM) and All-Trans-Retinoic (10 µM and 50µM) for 96 hrs, to establish the effect of RA in the proliferation and differentiation of the HNSCC cell line CAL27. Furthermore a possible RA modulation will be determined over the expression of the metalloproteinase MMP9 and VEGF-R mRNA expression using RT-PCR. In the future, the effect of RA in VEGF-R protein levels using immunocytochemistry will be studied.

SPRING CENSUSES OF THE BIRD COMMUNITY IN THE PIÑONES FOREST IN LOÍZA, PUERTO RICO

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A new spring census was made to complement the ecological evaluation of a bird community from the Piñones Forest in Loíza, Puerto Rico. This evaluation was started in the autumn of 2003. Three relative abundance surveys were conducted (between 8:30 and 10:30 AM). A lineal transect of 2 km of total longitude was used to sample three types of vegetable formations: mangrove forests, secondary marsh forests and grasslands with a mixture of both first types of forest. The transect width was variable: 10 m in the mangrove areas and 15 m in the forest and marsh grasslands. A rhythm of walking that did not surpass one km/hr was used. The total richness of the species, the richness by type of habitat, the taxonomical structures of the community, as well as the relative abundance of each species were determined (birds/ha). The present results are compared with those of Dali and Alvelo (2004) and Blanco et al., (2003) obtained with equal methodology during the months of July, 2003 and July 2004.
POTENTIAL VICTIMS OF THE REPRODUCTIVE PARASITISM OF THE SHINY COWBIRD IN THE COMMUNITY OF BIRDS OF THE PIÑONES FOREST

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The Shiny Cowbird is native of South America. The first report of its presence in Puerto Rico territory dates back to 1860 in Vieques, where one that escaped from a cage was spotted in the wild life. Nesting populations have been known in Puerto Rico since 1955. Shiny Cowbird is a bird with parasitic reproductive habits. Its strategy is to lay eggs in nests of other species, thus reducing the successful reproduction of endemic and other native species such as Viero latimeri, “Mariquita” Agelaius xanthomus and Dendroica petechias. Through the census of birds conducted at the Piñones Forest in Loíza, Puerto Rico, during summers of 2003 and 2004, the fall of 2005, and the spring of 2007, the relative abundance of this species was determined in three types of habitats as well as that of the species susceptible to being its victims and its reproductive parasitism.

SPRING CENSUSES OF BIRD COMMUNITY FROM MARTÍN PEÑA CANAL, SAN JUAN, PUERTO RICO

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Birds constitute a very important group within the fauna of vertebrates. This group of animals plays an important role in the ecosystems of the whole planet, and they are a crucial part of the food chain of the majority of ecosystems. In the present report, the results of a brief study on the bird community from the Martín Peña Channel in the vicinity of the recreational area known as the Enrique Martí Coll Lineal Park in the city of San Juan are presented. The objectives are centered on updating the known list of bird species that live in the area, estimate their relative abundance, describe their taxonomical composition, and compare the results with those obtained during the censuses made in the autumn of 2002 (Rodríguez et al, 2002). A total of two bird censuses were made following the Census Itinerary method to obtain the relative abundance values using area (in ha) as a measurement unit.
CHEMISTRY

BIODIESEL: CULTIVATING ALTERNATIVE FUELS

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The shortage of a crude oil supply and air pollution caused by vehicle emissions all over the world have lead to the development of alternative biofuels such as Biodiesel (B100). Production of biodiesel fuel from triglycerides and short-chain alcohol is done by transsesterification in a batch reactor using used cooking oil. The long-chain fatty acid ester, which is the product of this reaction, can be used as a diesel fuel that does not produce sulfur oxide and minimizes the soot particle in comparison with the existing one from petroleum. Process refiners mix the oil with alcohol in the presence of a catalyst. This reaction can be made with a strong methoxide sodium salt and then transferred to the bucket. Biodiesel is a mono alkyl ester of long chain fatty acids derived from renewable waste cooking oil that performs similarly as petroleum based diesel for use in the compression of internal combustion engines. The oil is considered good in accordance with the listed DN-56016 biodiesel standard. As an added hindrance, B100 has strong solvent properties that liberate rust and other engine contaminants, which plug filters and fuel injectors. With repeated use, however, B100 and biodiesel blends “clean” engines of these contaminants, which become less troublesome with time.

GREEN POWER FUEL FOR GLOBAL WARMING

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In many parts of the world, ethanol, produced by fermentation of carbohydrates from crops such as maize, fruits, and sugar cane, is seen as a way of supporting farmers and reducing dependence on imported fossil fuel. Higher oil prices are making “gasohol” increasingly economic. Biologically produced alcohol reactions, use the action of microbe enzymes through fermentation in conversion of biomass mainly to anhydrous Bioethanol and Biomethanol from the glucose extraction of the mango fruit. The use of ethanol as an oxygenate has long been touted as reducing air pollution, and the study did find that 10% ethanol used as an additive instead of methyl tert-butyl ether (MTBE) can reduce emissions of carbon monoxide, volatile organic compounds, and particulate matter with a diameter of less than 10 μm. Promotional measures have been devised by the Department of Energy to encourage the use of Gasohol fuel. Gasohol 95 in comparison to Octane 95 has less cost per bath/liter. The distribution of gasohol has been intensified across the U.S.
The investigation goal was to make a bulb more resistant and longer lasting for houses and big companies. For this purpose the investigators used their experience in the area of electronics. The idea proposed was to make a bulb based on diodes, specifically an LED (Light Emitting Diode), one that uses the lowest voltage and current but the maximum of mcd (milicandela). The LED technology is based on semi-conducting material that with electricity responds emitting a cold light that is considered high quality. This LED is different from a regular light bulb because the electrical power is converted to light and a regular bulb consumes a great part of this power in heat. To make the bulb, a schematic diagram was used based on the Ohms theory on circuit series and parallel. In this case the researchers decided to make two circuits in parallel and place them in series. The circuits in parallels consume less voltage and save the consumer more money. Once decided which way the bulb would be made, it was assembled in a plastic bowl connecting the LED, the diodes were welded using a welding tool and cable. Twenty-four (24) diodes were connected in parallel with a voltage of 3.5 or 4V and a current of 800 mA. After assembling the LED light bulb, some measurements were made to see how much mcd the incandescent bulb and the fluorescent bulb had in comparison with the LED. A series circuit with a photo-resistor was used to make the measurements; the data obtained was used to compare these two types of bulb with the one that was assembled.
INDEX OF REFRACTION FROM VARIOUS POINTS AROUND THE ISLAND’S COAST OF PUERTO RICO

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Scientists have been trying to unlock the mysteries of the deep ocean for many years. They are constantly searching for new ways to observe and study the animal life of the sea, which is still a mystery. An important part of studying sea life is developing cameras that are able to take clear pictures underwater. Salty water causes the incoming light to refract, or bend, causing the image to distort and appear at a different position than where it really is. The index of refraction is a number that expresses how much the speed of light of the light ray is reduced by the medium. The accepted value of the index of refraction of plain H₂O is 1.33. The problem is salinity if the seawater affects that number, and that varies depending on the percent of salinity. The researchers calculated the index of refraction using samples from various points around the coast of Puerto Rico. Using a refract meter the values of salinity were measured in each sample experimentally and using the formula for calculating the index of refraction known as Snell’s Law, the incidence of refraction of each sample was calculated. At a temperature of 23 °C, the experimental values of the index of refraction for the collected samples were: Salinas 1.341±0.0558, Escambrón in San Juan 1.357±0.0109, La Guancha in Ponce 1.358±0.098, Boquerón in Cabo Rojo 1.288±0.1595, Isla Verde in San Juan 1.367±0.1. Using lineal regression and correlation, it was found that the variable indexes of refraction and salinity were related. The study revealed that the percent of salinity of the seawater affected the index of refraction.
ENVIRONMENTAL SCIENCES

HEAVY METAL POLLUTION IN ECOLOGICALLY AND CULTURALLY IMPORTANT RIVERS IN PUERTO RICO

Katherine Ruíz, Radians School, Cayey, Puerto Rico

Research Mentor: Julio De Jesús, Radians School, Cayey, Puerto Rico.

While conducting a study on the prevalence of bilharzia in Puerto Rico, a disease caused by the digenetic trematode parasite Schistosoma mansoni, the decrease of the incidence of bilharzia in the last decades was noticed, apparently secondary to biological controls, urbanization and general well being of Puerto Rican society. Furthermore, it was found by Wanas (1998) that larval stages of Schistosoma are sensitive to specific levels of cadmium and mercury. This statement lead to the driving question of this study: Would the decline and absence of Schistosoma in local rivers be an indicator of heavy metal pollution? To address this question, samples of water were analyzed for the presence of bilharzia and also for the presence of the following heavy metals: cadmium, iron, lead, mercury, manganese, nickel, copper and zinc. This was done using a LaMotte colorimeter measuring the concentration in parts per million. In addition, a toxicity test with Daphnia magna was run for 48 hrs following a standard protocol. The study was negative for the presence of Schistosoma mansoni cercariae in the tested rivers. It was also found that levels of cadmium, lead, manganese and mercury were above the acceptable levels for wildlife safety. The only heavy metal that was above the tolerance levels for S. mansoni cercariae was cadmium, but the level of mercury although not toxic to cercariae, it is toxic to Daphnia with a mortality that ranged from 58 to 100% in 48 hrs. In conclusion, the tested rivers showed heavy metal pollution being the most frequent pollutants cadmium and mercury. Management recommendations are presented.

RELATIONSHIP BETWEEN FUNGAL GROWTH AND HUMIDITY PARAMETERS IN CONCRETE

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The objective of the investigation was to verify if the concrete relative dampness makes the material viable for construction in the tropics. Fungi samples in the material were taken and fungal presence was detected. Results were compared with fungal presence in other materials like wood and fiberglass. It was determined that the painting does not protect the concrete from the dampness. Concrete seems to be not the best construction material to be used in the tropics in terms of fungal development.
COMPARISON OF FUNGAL GROWTH IN RELATION WITH VARIOUS HUMIDITY PARAMETERS IN UNPROTECTED PLYWOOD

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Jessica M. Ortiz, Notre Dame School, Caguas, Puerto Rico.
Armando Rodríguez, Gerardo Sellés Solá School, Caguas, Puerto Rico.

Research Mentor: Ángel Villalba, Universidad del Turabo, Gurabo, Puerto Rico.
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In this investigation, various humidity parameters were measured on unprotected plywood to determine the presence of fungi in the material. The measured parameters were: surface humidity, dew point, absolute humidity and temperature. After the data was collected, a swab test was performed to determine the presence of fungi growth on the plywood. The objective of the investigation was to compare the results with other materials to determine which one shows the most presence of fungi. Among plywood, concrete and fiber-glass, and acoustic panels, plywood proved to have more fungal growth. It was proved that plywood, due to the porosity of the material and its molecular structure, retains more humidity and thus it should not be used for construction in the tropic because it is prone to microbial infection due to growth of mold.

COMPARISON OF FUNGAL GROWTH IN RELATION WITH VARIOUS HUMIDITY PARAMETERS IN FIBERGLASS

Juliana Rivera, Ninoshka Bernabé, Alexis M. Oquendo, Felipe Rivera Centeno School, Caguas, Puerto Rico.

Research Mentor: Ángel Villalba, Universidad del Turabo, Gurabo, Puerto Rico.
Assistant Research Mentor: Carmen Bonilla, Universidad del Turabo, Gurabo, Puerto Rico.

The purpose of this study was to determine the viability of fiberglass acoustic panels by comparing them with different construction materials of common use in the tropics. By measuring diverse humidity parameters (relative humidity, surface humidity, dew point, absolute humidity, temperature °F) and by detecting fungal growth it was discovered that the acoustic panel made with fiberglass (artificial fiber) retains less humidity than other construction materials such as concrete and wood.
AIR TEMPERATURE FLUCTUATION EFFECTS ON GROWTH AND DEVELOPMENT OF *LACTUCA SATIVA* L

**Gabriel Sotero**, Bautista de Carolina Academy, Carolina, Puerto Rico.  
**Hevayliz Vega**, María Auxiliadora School, Carolina, Puerto Rico.

Research Mentor: Elizabeth Díaz, School of Science and Technology, Universidad del Este, Carolina, Puerto Rico.  
Student Mentor: Lourdianie Soto, School of Education, Universidad del Este, Carolina, Puerto Rico.

Lettuce, *Lactuca sativa* L. is a leafy vegetable that thrives in cool climates. Under high temperature conditions this plant tends to produce more stems than leaves. In this study this plant was used as an indicator of the effects of fluctuation in temperature or the simulation of global climate change on growth and development. Forty seeds of *Lactuca sativa* L. were sown in a seedbed and placed in a greenhouse at UNE. Half of these seeds (20) were placed in a fish tank to simulate a high temperature environment. The rest were left on the greenhouse bench. Air temperature readings were taken three (3) times a day at each location. The plants were evaluated for percent germination, number of leaves and stem length. The high temperature treatment affected the germination rate of the lettuce seeds.

THE EFFECTS OF ACID RAIN ON THE GROWTH AND DEVELOPMENT OF *LACTUCA SATIVA* L


Research Mentor: Elizabeth Díaz, School of Science and Technology, Universidad del Este, Carolina, Puerto Rico.  
Student Mentor: Lourdianie Soto, School of Education, Universidad del Este, Carolina, Puerto Rico.

Lettuce, *Lactuca sativa* L. is an annual crop that can be harvested in 80 days. It also produces abundant leaves and can be used as a good indicator of the effect of acid rain on plants. Forty seeds of *Lactuca sativa* L. were sown in a seedbed and placed in a greenhouse at UNE. Half of these seeds (20) were irrigated for three (3) weeks with water with a low pH. The rest were irrigated with water with a neutral pH. Air temperature readings were taken three (3) times a day at each location. The plants were evaluated for percent germination, number of leaves and stem length. The acid rain treatment affected the germination rate of the lettuce seeds.
THE EFFECTS OF WET AND DRY TROPICAL CLIMATES ON THE BEHAVIOR OF THE ACHETA DOMESTICUS

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The house cricket, Acheta domesticus L., Order Orthopetra is very common throughout Puerto Rico. This species was used as an indicator of the effects of two ecosystems or a simulation of changes in global climate on the behavior of insects. The importance of this experiment was to observe how an organism can adapt to the environment undergoing temperature changes. This species was evaluated to ascertain how it can adapt to an environment undergoing the greenhouse effect. Two (2) ecosystems were simulated using 25 gallon fish tanks. One environment was dry tropical and the other a wet tropical climate. Ten (10) crickets were placed in each ecosystem and observed for six (6) days. The same number of crickets survived in both ecosystems; however, crickets survived better in the dry climate.

STUDIES OF pH LEVELS OF WATER SAMPLES TAKEN FROM STREAMS IN THE MUNICIPALITIES OF CAROLINA AND TRUJILLO ALTO

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A very important variable that determines water quality is pH. This variable helps to indirectly determine potential biological activity, and chemical contamination. Our specific objective was to investigate the pH levels of three streams, two in the Municipality of Carolina (Barrazas and Santa Cruz), and one in the Municipality of Trujillo Alto (Quebrada Grande). Three (3) water samples were taken from each stream for 10 days. The pH levels of the streams were alkaline, possibly due to the pollution by adjacent industries.
BIODIVERSITY LIMITATIONS IN THE UNE WETLAND

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Selimar Ledesma and Germaine Peña, Luis Hernaiz Veronne High School, Canóvanas, Puerto Rico.
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The UNE wetland is a lacustrine system. Lacustrine systems are aquatic deposits formed in topographic depressions or dammed drainages natural or artificially. It can have vegetation like emerging or floating plants, mosses and lichens. Its salinity can be up to 5 parts by thousand. It includes interior lagoons and lakes whose profundity surpasses two meters. The primary causes of species endangerment are habitat loss and degradation, introduced (non-native) species, as well as pollution, human population growth, climate changes, and overconsumption of resources. Of these, habitat loss is considered by many biologists to be the most pervasive threat to biological diversity. A wetland with an ample biodiversity can be considered as a healthy and functional ecosystem. In this study, the possible causes of the wetland degradation that impact the biodiversity of flora and fauna were determined and identified. The wetland was visited to observe, identify and classify the species that inhabit this ecosystem. A poor variety of biodiversity was observed in the three visits. The conclusion of this study is that the biodiversity has been negatively affected.

THE POTENTIAL OF WETLANDS AS HEAT ABSORBER

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Student Mentor: Carlos Rivera, School of Education, Universidad del Este, Carolina, Puerto Rico.

The UNE wetland is a lacustrine system. Lacustrine systems are aquatic deposits formed in topographic depressions or dammed drainages natural or artificially. It can have vegetation like emerging or floating plants, mosses and lichens. Its salinity can be up to 5 parts by thousand. It includes interior lagoons and lakes whose profundity surpasses two meters. The objective of this study was to determine if the wetland of the UNE is a heat absorber of the UNE and periphery area. Air temperature was measured in 4 different distances from the wetland. The UNE wetland was studied with the objective of determining if this particular ecosystem has the ability to absorb heat in the area. It was hypothesized that this wetland must be an excellent heat mitigation ecosystem. It was observed that this wetland was impacted negatively, had limited water, biodiversity and invasive terrestrial plant species. The study had the purpose of determining if there are variations in temperatures according to the distance from the wetland. The study tried to determine if there is a direct relationship between lower temperatures and distance from the wetland.
QUALITY OF WETLAND WATERS

Gissel De La Rosa, Melanie Gómez, Valerie Gómez, and Verónica González, Antonio Barriera High School, Carolina, Puerto Rico.

Research Mentor: Raúl Santini, School of Science and Technology, Universidad del Este, Carolina, Puerto Rico.
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The Universidad del Este (UNE) wetland is a lacustrine system. Lacustrine systems are aquatic deposits formed in topographic depressions or dammed drainages natural or artificially. It can have vegetation like emerging or floating plants, mosses and lichens. Its salinity can be up to 5 parts by thousand. It includes interior lagoons and lakes whose profundity surpasses two meters. The objective of this study was to determine the water quality of the wetland at UNE. The different parameters evaluated were: pH, Biochemical Oxygen Demand (BOD) Sedimentation, temperatures and salinity. The water samples were compared with the standards of quality of water for Puerto Rico. The quality of the water resource is one of the principal indicators of the conditions of the ecosystems. In this particular type of wetlands, water is degraded by the land uses, human activities and area development around the wetland.
ENGINEERING

SIMULATION OF ROBOTS IN AN INDUSTRIAL ENVIRONMENT

José R. Pacheco, Frank Martínez, and Miguel Jiménez, Bautista de Puerto Nuevo Academy, San Juan, Puerto Rico.
Luis Torres, Miguel de Cevantes High School, Bayamón Puerto Rico.

Research Mentor: Dr. Juan F. Arratia, Director and Principal Investigator, Model Institutions for Excellence, Universidad Metropolitana, San Juan, Puerto Rico.
Student Research Mentor: José M. Cardona, Universidad Metropolitana, San Juan, Puerto Rico.

Robots – autonomous, programmable, multipurpose machines – have become an essential part of modern society. In industrialized countries a great part of the work once done by human labor is now handled by simple machines programmed to carry out the same operations over and over, increasing the speed and efficiency of many manufacturing processes. Robotics is also used to handle situations far too dangerous to employ humans (i.e. military recon, bomb disposal, mining, toxic-waste cleaning). This project focuses on the development of the prototype of an industrial robot that will facilitate transportation of different materials that are necessary to carry out manufacturing processes. The robot was to be autonomous, and would react to certain stimuli (objects blocking its path, for example) with pre-programmed responses (it would be able to detect changes through Infrared and QTI Line sensors). In this project, Parallax Sumo-Bots programmed with PBASIC was used. The robot prototype could not react properly to consecutive changes in the environment. Project findings indicated that the robot only functioned properly if the environment was not prone to sudden changes. Further testing will need to be carried out to properly correct this problem.

BUILDING AND PROGRAMMING A ROBOTIC ARM FOR THE USE OF SURGICAL PROCEDURES

Eduardo Alvarez, Menonita Academy, San Juan, Puerto Rico.
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Building a robotic arm takes many processes which start from learning about the machine the group is building all the way to programming the machine to perform the task at hand. Learning about how electric pulses control the robot servomotors was the first stage of the project. The group was informed of the many forces that had to be overcome in order for the machine to perform at its best. Afterwards, the design was made of a concept drawing for a robotic brain surgery using Solid Works 2007. This program helped construct the machine in a 3-dimensional drawing with the right measurements and angles that the real robotic arm would be able to move. This helped the group have a greater understanding of how a complex robot works. A robotic arm kit was obtained and the group was able to put it together successfully. The objective was to program the microcontroller in order for it to send electric pulses to the servomotors to move the arm according to the sensors used. This project provided the group with the opportunity to use common math and science skills as well team work in order to accomplish an important task for not only the doctors who use such machines, but for the patient on the other end of the needle. The work done has broadened the understanding for the members of the group and promoted the use of technology in the field of medicine and the improvement of life in the world.
THE EFFECTIVENESS OF THE AJ CONDENSER

José González-Goitía, Abner J. Hernández, Dr. María Cadilla High School, Arecibo, Puerto Rico.

Research Mentor: Miguel A Nieves, Dr. María Cadilla High School, Arecibo, Puerto Rico.

The AJ condenser is a homemade device that converts water from the atmosphere into liquid water using CO$_2$. The purpose of this homemade condenser is to find a solution to water shortage caused by global warming. The purpose of this investigation was to find out if the condenser AJ was effective in accelerating the process of water condensation utilizing a CO$_2$ tank. The process to construct the AJ condenser included two holes of $\frac{1}{2}$ inch to the cooler in the upper left side and another in the lower right side. Then cooper tube was bent approximately 140 degrees and it was introduced in each hole. The holes in the cooler were sealed and a capillary was rolled around the $\frac{1}{2}$ inch tube. The cooler was covered and the valve of the capillary was connected to the CO$_2$ tank. To test the condenser AJ, 100 ml of water in its vapor state were needed and it was passed through the $\frac{1}{2}$ inch tube so that the capillary with the CO$_2$ yielded 3 ml of water without CO$_2$ and 2ml of water was obtained. In conclusion, 1 ml more of water with CO$_2$ could be obtained than without it. Other data found included that the more quantity of CO$_2$ obtained, more water was also obtained. At the end of the investigation it was demonstrated that the hypothesis was true.

TRANSFORMER

Henry Rodríguez, Michael Maymí, Thomas A. Edison High School, Caguas, Puerto Rico.

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The project consisted of building a step-up transformer to which two volts AC were applied to the primary coil in order to attain twelve volts AC at the secondary coil. To calculate voltage, current and number of turn in the coil, the ideal transformer equation was utilized. Knowing that the transformer built was not 100% efficient, more turn in the secondary coil was required. To achieve 12 volts, in theory, the secondary coil turns was approx. 840 but, the experimental turns utilized was approx. 1400 and in the primary coil a 140 turn was employed. A machine was designed to build the copper coils. This machine operated with the use of an electrical motor and pulleys. The iron nucleus made the difference in voltage at the secondary coil since it improves the magnetic flow that circulates between the coils, and it increases the induction at the secondary coil. Various types and configurations of the nucleus were used. For the purpose of this study, an iron bar with extracted plates from a commercial transformer was used. Once the transformer was built to determine its efficiency, measurements of voltage, current, and resistance were taken from each coil. Although temperature measurements were not taken, it is a known factor in determining the transformer efficiency since part of the energy was converted into heat.
IONIZED HYDROGEN: A NEW EVIDENCE OF THE SOUTHERN WARP

Charles A. Lozada, Ramón Power & Giralt High School, Las Piedras, Puerto Rico.

Research Mentor: Prof. J. C. Cersocimo, University of Puerto Rico-Humacao Campus, Humacao, Puerto Rico.

It has been known since 1957, following the first 21-cm sky surveys, that our galaxy is strongly warped. There is evidence that can tell us that there is a warp on the northern side of the galaxy but there is not too much information for the southern side. The hypothesis is that there is a warp in the southern side too. Early search for evidence of a warp in the ionized gas layer, was obtained at H166a observation in both southern and northern portions of the galaxy. The northern observations provided a sensitive receiver, but the southern observations were performed with a less sensitive receiver. The H166a line in the southern region was detected in only 11 positions, 12% above the minimum detectable temperature of mK. The search was motivated in order to obtain very sensitive data from the ionized component which should be associated with warped regions of the Galaxy. The main purpose of this project was to analyze all the data obtained during March 2005. The data were taken at the Parkes 64 meters telescope in Australia. The data were obtained in a frequency-switching mode with a central frequency of 1423.5 MHz. The multibeam correlator was set up with 512 channels and a bandwidth of 4 MHz which covers the velocity range –496 to 667.4 km/s. The first task was to fit the base line to the data, information on the distance and the amount of the ionized gas. The study of the region around l=270 showed emissions, that revealed that the hydrogen ionized gas was located below the Galactic Plane, which confirms the existence of warp ionized gas, like a neutral component does. As a preliminary result, it is concluded that there is a warp in the southern side of the Galaxy.
ACKNOWLEDGMENTS

Faculty research mentoring is the main driving force behind the scientific products (posters and oral presentations) presented in this symposium. Our greatest appreciation and gratitude to all the mentors who took part in the Spring 2007 Pre-College Research Symposium by working and training the next generation of scientists whose efforts are presented in this booklet, as well as to the many other faculty members who support the MIE Project and its goals and objectives. Our most sincere thanks are also extended to the following individuals who helped to make this Spring 2007 Pre-College Research Symposium possible.

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We gratefully acknowledge the support and sponsorship of the Spring 2007 Pre-College Research Symposium from:

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