THE 2002 NEW MEXICO AMP

STUDENT RESEARCH CONFERENCE

SEPTEMBER 12-14, 2002
NEW MEXICO
STATE UNIVERSITY

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"Reaching Beyond"

2002 Student Research Conference

Sponsored by

The New Mexico Alliance for Minority Participation

And

Raytheon Missile Systems Company

September 12-14, 2002

New Mexico State University

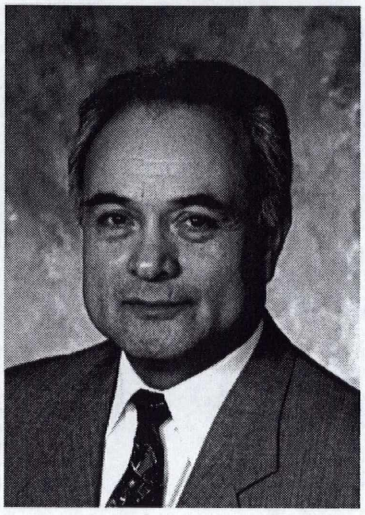
Las Cruces, New Mexico

Acknowledgements:

New Mexico AMP wishes to acknowledge and thank Raytheon Missile Systems Company for their financial support of the 2002 Student Conference

NMSU M-Tech faculty member Anthony Hyde, and students Kim Parkey, James Eaton, and Matt Garcia for the "Starman" figures

Peter Piper Pizza for their donation of ice cream cones for the New Mexico MESA students



Dr. Ricardo B. Jacquez
Director, New Mexico AMP

WELCOME . . .

to the 2002 New Mexico AMP Statewide Undergraduate Student Research Conference, sponsored by the New Mexico Alliance for Minority Participation and Raytheon Missile Systems Company.

We ask to you to look at the conference as a way to help you set and achieve your personal and educational goals. As we note the first anniversary of the World Trade Center and Pentagon attacks, we are especially aware of the need for an informed, educated, and dedicated 21st century workforce. We hope you will take advantage of the activities that most closely relate to your needs and goals as a student now and for your work in the future. We encourage you to take advantage of the information and expertise being showcased during these two days.

Enjoy your time at New Mexico State University. Network, learn, have fun, and take home the tools and information to make the most of your academic and future professional career.

Thank you —
To the administrators and staff, faculty, mentors, and parents for the time, energy, support, and encouragement you have given the students and the research projects represented in this publication.

New Mexico AMP

"Reaching Beyond"

AGENDA

THURSDAY, September 12, 2002

4:00 pm – 7:00 pm	**Pre-Conference Registration** (Lobby outside Ballroom/Corbett Center – 3rd floor)
5:00 pm – 7:00 pm	**Dinner** (Taos Cafeteria/Corbett Center – 1st floor)
	Poster set up (West Lobby/Corbett Center – 2nd floor)

FRIDAY, September 13, 2002

7:00 am – 7:45 am	**Poster set up continues** (West Lobby – 2nd floor)
7:30 am – 11:00 am	**Conference Registration** (Lobby outside Ballroom – 3rd floor)
7:30 am – 8:00 am	**Breakfast*** (Ballroom – 3rd floor)
7:30 am – 8:45 am	**New Mexico AMP Judges' Breakfast** (Doa Ana Room – 3rd floor)
8:00 am – 8:15 am	**Conference Welcome**—Ricardo Jacquez, Director, New Mexico AMP; Jay Gogue, President, NMSU; Kenneth White, Interim Dean, College of Engineering **Invocation/Moment of Remembrance**—Shaynor Newsome, Campus Minister for the Reformed University Fellowship at New Mexico State University
8:15 am – 8:45 am	**Keynote Address**—Vicente Chavez Garcia, Jr., Technical Director for Cryptology, Physical Science Laboratory, NMSU
9:00 am – 11:30 am	**New Mexico AMP Student Oral Research Presentations** (Corbett Center – 3rd floor) (see abstracts p. 14)
11:45 am – 1:00 pm	**Lunch*** (Ballroom - 3rd floor) **New Mexico AMP Judges' Lunch** (Doa Ana Room – 3rd floor) **Luncheon Speaker**—Ben Altamirano, State Senator, New Mexico **Introduction of University Research Council (URC) Faculty and Presentations**—Daniel Dwyer, Vice Provost for Research
1:00 pm – 2:30 pm	**URC Faculty Poster Presentations** (South Lobby – 2nd floor)
1:00 pm – 2:30 pm	**Information/Display Tables** – *NMSU Financial Aid; Admissions; Housing; Placement and Career Services; NSF Alliance for Graduate Education and the Professoriate (AGEP) Programs; University of Arizona Graduate College* (TV Lobby – 2nd floor)
1:30 pm – 4:40 pm	**SMET 101 Project Meeting** (Quay Room – 3rd floor)

* *Vegetarian meals are available upon request.*
Tickets are required for all meals—Breakfast-yellow; lunch-red; dinner-blue

FRIDAY, September 13, 2002 (continued)

2:40 pm – 4:40 pm **University Research Council's "Exceptional Achievements in Creative Scholarly Activity" 2001 Awardees Presentation** (see abstracts p. 13)
(Demonstrations will follow the presentations.)
Paul Bosland, Department of Agronomy and Horticulture (Senate Chambers)
Anatoly Klypin, Department of Astronomy (Senate Gallery)
Jaime Ramirez-Angulo, The Klipsch School of Electrical and Computer Engineering (Room 315)
Note: Refreshments will be available in these rooms during the presentations.

2:40 pm – 4:40 pm **Graduate School Panel and individual time with AGEP recruiters**
Panel Moderator—David Jauregui, Asst. Professor, Civil and Geological Engineering, (New Mexico Room – 3rd floor)

2:40 pm – 4:40 pm **MESA-Sponsored NMSU Campus** (board the bus in parking lot #27 east of Corbett Center)
M-Tech /Lego Lab Tour (board the shuttle in parking lot #27 east of Corbett Center)

4:15 pm – 5:15 pm **Poster Judges' Orientation and Dinner** (Doa Ana Room – 3rd floor)

4:45 pm – 6:00 pm **Dinner*** (Ballroom – 3rd floor)
Entertainment – ***Mariachis Espuelas de Plata***
Note: Dessert will be served at 6:00 pm at the West end of the 2nd floor lobby.

6:00 pm – 7:00 pm **Student Poster Research Presentations** (West Lobby – 2nd floor)
Informational/Classroom-Based Project and Display Posters (North Lobby – 2nd floor) (see abstracts p. 24)
"Dessert Bar" (West Lobby – 2nd floor)

7:00 pm – 7:20 pm **Door Prize Drawing** (Lobby by Art Gallery – 2nd Floor)

SATURDAY, September 14, 2002

8:00 am – 8:50 am **Breakfast*** (Ballroom – 3rd floor)
New Mexico AMP IC's Breakfast (New Mexico Room – 3rd floor)

9:00 am – 9:30 am **Industry Workshops – 3rd Floor**
(Note: These workshops will be repeated at 9:30 am – 10:00 am and at 10:00 am – 10:30 am.
Hewlett Packard (Senate Chambers)
Raytheon (Senate Gallery)
USA (Room 317)
BLM (Room 315)
Agilent (Doa Ana Room)

10:30 am – 11:30 am **Snack Break** (Star Lobby Outside Auditorium – 2nd floor)

11:00 am – 12:30 am **Expert Panel: Educating the 21st Century Information Operations Workforce** (Auditorium – 2nd floor)
Panel Moderator—Vicente Chavez Garcia, Jr.
Panel Members: Raymond Bernstein; Rasler Smith; Willis A. Janssen; Michael Coombs, James Holded-Rhodes

12:30 pm – 2:00 pm **Awards Luncheon*** (Ballroom – 3rd floor)
Door Prize Drawing (Ballroom – 3rd floor)

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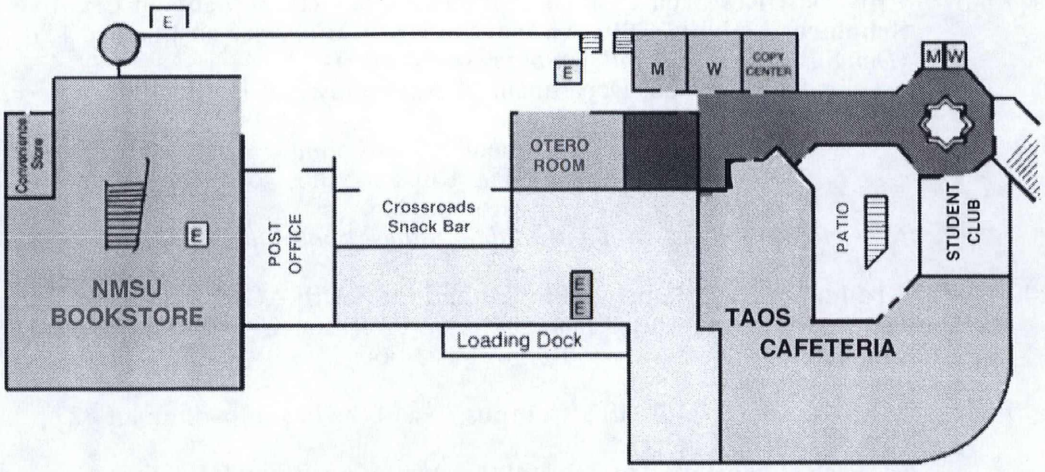
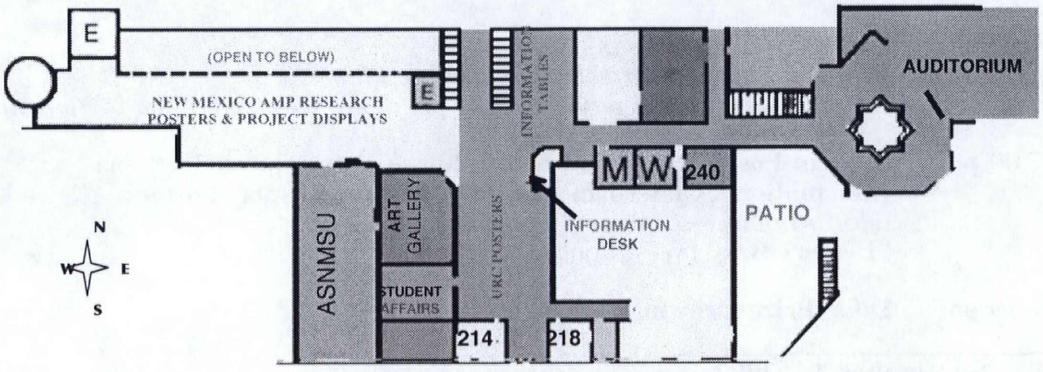
* *Vegetarian meals are available upon request.*
Tickets are required for all meals—Breakfast-yellow; lunch-red; dinner-blue

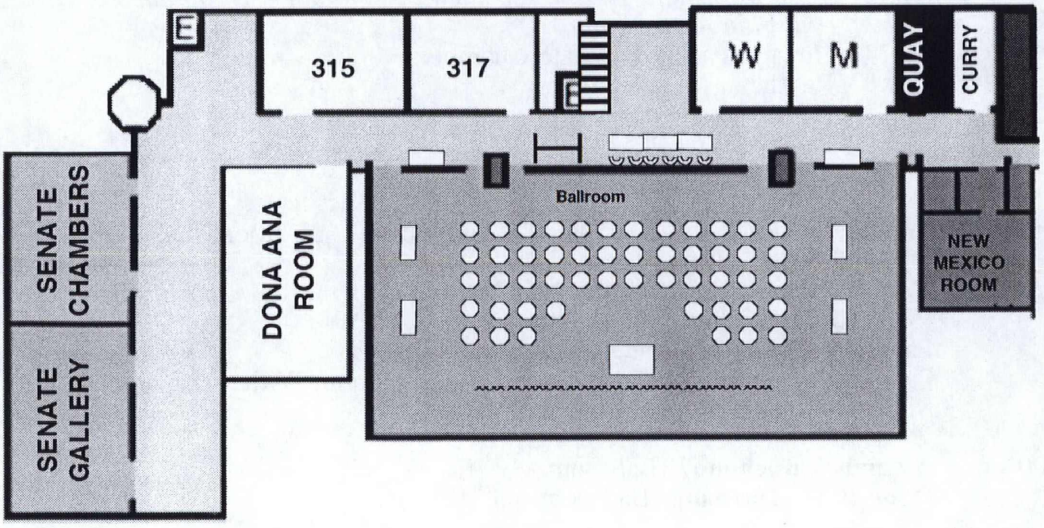
Corbett Center, First Level



Corbett Center, Second Level



Corbett Center, Third Level



Keynote Speaker

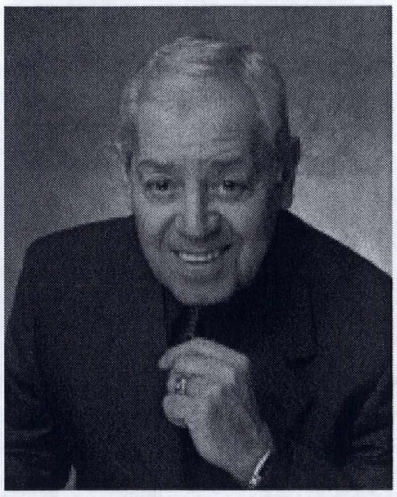
Vicente Chavez Garcia, Jr.
Technical Director for Cryptology
Physical Science Laboratory
New Mexico State University

Vicente Chavez Garcia, Jr. received an MS in Electrical Engineering (Distinction) from the U.S. Naval Postgraduate School in Monterey, California; an MS in Engineering from the University of Central Florida, Orlando, Florida; and a B.S. in Electrical Engineering from New Mexico State University. He has over 27 years experience in government service, including 24 years of military service. He was recently promoted to Captain in the United States Navy Reserve on March 2000, the only one selected from nine Cryptologic Commanders. Garcia was employed by the National Security Agency from 1989 through 2000 as a Cryptologic Engineer before beginning work as the Technical Director for Cryptology at the Physical Science Laboratory at New Mexico State University.

Garcia's previous positions have included NSA Visiting Professor, U.S. Naval Postgraduate School, Monterey, California; DOD Technical Director, Denver, Colorado; NSA Consultant, NSA/CSS, National Test Bed Facility/Falcon Air Force Base, Colorado; NSA Visiting Professor, Astronautics Department, U.S. Air Force Academy, Colorado Springs, Colorado; Division Chief, Search and Signal Analysis, DOD Overseas Field Site; and Adjunct Faculty, National Security Agency, National Cryptologic School.

Garcia has been recognized by the government as an international expert in National Cryptologic Systems and the technical perspective of Information Operations. During his professional career, he performed missions in Cryptologic/IO operations, research and education. Garcia's awards and recognition have included the Department of the Navy Meritorious Civilian Service Award, NSA Exceptional Civilian Service Award, NPS Outstanding Instructional Performance in 1997, New Mexico State University Centennial Distinguished Alum, NSA Meritorious Civilian Service Award (based on Total Quality Management) and the National Cryptologic School Adjunct Faculty of the Year, 1993.

Luncheon Speaker



Ben Altamirano
State Senator, New Mexico

State Senator Ben Altamirano has served as New Mexico State Senator since 1971, representing Catron, Grant and Socorro Counties. A lifelong resident of Silver City, Altamirano, is also a businessman, having over 40 years experience in retail sales and insurance. Altamirano and his wife, Nina, have three children, eight grandchildren, and three great grandchildren.

Altamirano attended school in Pinos Altos and Silver City, New Mexico, graduated from high school in Silver City, and attended Western New Mexico University in Silver City.

He is a veteran of World War II, having served in the European Theatre of Operations (Germany). He was elected Silver City Town Councilman (1960-70); Grant County Commissioner (1966-1970); and State Senator in 1971.

As a state senator, Altamirano currently holds membership or chairs nine committees including the Legislative Council, Legislative Finance Committee, Legislative Committee on Compacts, Corrections Oversight and Justice Committee, Economical and Rural Development and Telecommunications Committee, Natural Gas Pipeline Study Committee, Revenue Stabilization and Tax Policy Committee, Finance, and the Welfare Reform Oversight Committee.

University Research Council Award for Exceptional Achievements in Creative Scholarly Activity

The University Research Council Award for Exceptional Achievements in Creative Scholarly Activity awards will be presented annually to early career and senior faculty and staff. The award is designed to increase recognition for exceptional research and other creative scholarly efforts at New Mexico State University. The following are the first to receive this award:

Jaime Ramírez-Angulo is currently Professor, IEEE fellow and Director of the Mixed-Signal VLSI lab and the NASA Center for Autonomous Control Engineering (NASA-ACE) at the Klipsch School of Electrical and Computer Engineering, New Mexico State University (Las Cruces, New Mexico), USA. He received a degree in Communications and Electronic Engineering (Professional degree), a M.S.E.E. from the National Polytechnic Institute in Mexico City, and a Dr.-Ing degree from the University of Stuttgart in Stuttgart, Germany in 1974, 1976 and 1982 respectively. He was professor at the National Institute for Astrophysics Optics and Electronics (INAOE) and at Texas A&M University. Ramrez-Angulo's research is related to various aspects of design and test of analog and mixed-signal Very Large Scale Integrated Circuits. His numerous contributions to this field have been reported in over two hundred publications in the most prestigious journals and conferences in analog circuit design. He has two high technology patents and has held numerous invited and keynote presentations. He has been a consultant to Texas Instruments, NASA-ACE and Oak Ridge National Laboratories. Ramrez-Angulo's research has been supported by the National Science Foundation, Sandia National Labs, Engineering Foundation, Texas Instruments, and Agilent.

Anatoly Klypin, Astronomy Department, got his undergraduate degree (diploma) from the Moscow University. His PhD is from the Institute of Applied Mathematics. His supervisor—Jacob Zeldovich — was one of the "fathers" of the soviet hydrogen bomb. At that time he refused to participate in any military research and was studying astronomy. Klypin was a senior research scientist when the Soviet Union collapsed. It was not a good time to do research in astronomy, so, together with his family, he moved first to Canada and then to the U.S. where they found a home in Las Cruces. Klypin and his family like the city and the University which provides conditions for productive research and creative teaching.

Paul W. Bosland, professor of horticulture, is popularly known as the "Chileman." He leads the chile breeding and genetics research program at New Mexico State University. Dr. Bosland is recognized internationally as one of the foremost experts on Capsicum. He is also the co-founder and director of the world famous Chile Pepper Institute at New Mexico State University, the world's only research-based resource center for chile pepper information.

Bosland earned his B.S. degree U.C. Davis in 1976 in genetics, and an M.S. degree in vegetable crops in 1977. While at U. C. Davis, he also earned a secondary teaching credential and subsequently taught at the high school and the community college level. He returned to school at the University of Wisconsin-Madison and earned his Ph.D. in Plant Breeding and Plant Genetics in 1986. He joined the faculty in the Department of Horticulture at New Mexico State University in 1986, where he rose through the ranks to full professor in 1994.

He has received many honors and awards including the NMSU College of Agriculture and Home Economics Distinguished Researcher Award, inclusion in Who's Who in America, Wilson's Guide to Experts in Science and Technology, 2000 Outstanding Scientists of the 20th Century, among others. He was honored by the European Scientific Committee on Capsicum and Eggplant by being the first American ever selected to serve on this Committee. Dr. Bosland is a member of American Association for the Advancement of Science, American Society for Horticultural Sciences, Gamma Sigma Delta, New Mexico Academy of Science, and Sigma Xi.

Conference Events
Friday, September 13, 2002

1:00 – 2:00 pm

University Research Council Faculty Poster Presentations
Facilitator: University Research Council faculty members (South Lobby, Corbett Center, 2nd floor)

Who should attend: Students who will do oral and poster presentations today.

Description: An opportunity to see the current research going on at NMSU.

2:00 – 2:30 pm

Student/URC Faculty Informal Discussion (West Lobby, Corbett Center 2nd floor)
Facilitator: University Research Council faculty members

Who should attend: Students who will do oral and poster presentations today.

Description: An opportunity to meet one-on-one with these researchers to discuss their work and gain information and understanding of the role of faculty research at the university level.

1:00-2:30 pm

Display Tables (TV Lobby, Corbett Center, 2nd floor)
Facilitators:

Admissions: Patrick Natoni, Assistant Director, Office of Admissions

Financial Aid: Veronica Llanez, Assistant Director of Financial Aid

Housing: Missy Giacomelli, Associate Director, Housing and Dining Services

Placement and Career Services: Tawny Aguirre, Coordinator, Career Advising Service

National Science Foundation Alliance for Graduate Education and the Professoriate (AGEP) Recruitment: NMSU, UNM, and New Mexico Tech

Initiative for Minority Ph.D.s in Biomedical Sciences and Minority Health Disparities Program: University of Arizona Graduate College

Who should attend: All conference participants.

Description: Receive information on programs and services for new freshman through graduate school and talk to the experts.

2:40 – 4:40 pm

University Research Council's "Exceptional Achievements in Creative Scholarly Activity" 2001 Awardees Oral Presentations

Facilitators:

Paul Bosland, Department of Agronomy and Horticulture (Senate Chambers)
Anatoly Klypin, Department of Astronomy (Senate Gallery)
Jaime Ramrez-Angulo, The Klipsch School of Electrical and Computer Engineering (Room 315)

Presentation abstracts may be found on page 13. (*Demonstrations will follow the presentations.)*

Who should attend: All college and university students and faculty, in particular students who will do oral and poster presentations today.

Description: Meet one-on-one with these researchers to discuss their work and gain information and understanding of the role of faculty research at the university level.

Graduate School Panel Discussion

Facilitator: David Jauregui, Asst. Professor, Civil and Geological Engineering; Panel members include Paola Bandini, Asst. Professor, and Fernando Cadena, Professor, Civil and Geological Engineering

Who should attend: University juniors and seniors.

Description: Hear students and faculty present their experiences and advice on graduate school, the application process, working with mentors, selecting a committee and other topics of interest to the audience. Audience participation and questions are strongly encouraged.

MESA-Sponsored NMSU Campus Tour

Facilitators: Rose Marie Melon-Sanchez, College of Engineering, and Kris Havstad, USDA, Jornada Experimental Range Headquarters (board the bus in parking lot #27 east of Corbett Center)

Who should attend: New Mexico MESA students.

Description: Tour portions of the College of Engineering and College of Agriculture, student computer labs, and other areas of interest.

MESA M-Tech and Lego Lab Tour

Facilitiator: Anthony Hyde, Engineering Technology (board the shuttle in parking lot #27 east of Corbett Center)

Who should attend: New Mexico MESA students.

Description: Demonstrations of concepts in manufacturing technology.

Saturday, September 14, 2002

9:00 – 9:30 am (repeated 9:30-10:00 and 10:00-10:30)

Industry Internship and Employment Opportunities

Facilitators: Representatives from industry and government organizations

Who should attend: All conference participants.

Description: Learn about internship and employment opportunities from:

Raytheon Missile Systems — Raytheon today is focused on defense, government and commercial electronics, and business aviation and special mission aircraft.

Hewlett-Packard Company — Involved in large and small business computer solutions, including both hardware and software development.

Agilent Technologies — Operator of four businesses: test and measurement, semiconductor products, healthcare solutions and chemical analysis, supported by a central laboratory.

United Space Alliance (USA) — USA is chartered to manage and conduct space operations work involving the operation and maintenance of multi-purpose space systems, including systems associated with NASA's human space flight program, Space Shuttle applications beyond those of NASA and other reusable launch and orbital systems beyond the Space Shuttle and Space Station.

Department of Interior - Bureau of Land Management — The Bureau of Land Management (BLM) is responsible for managing 264 million acres of land—about one-eighth of the land in the United States—and about 300 million additional acres of subsurface mineral resources. The Bureau is also responsible for wildfire management and suppression on 388 million acres.

11:00 am – 12:30 pm

Expert Panel: Educating the 21st Century Information Operations Workforce

Facilitators:

Moderator—Vicente Chavez Garcia, Jr., Technical Director for Cryptology, Physical Science Laboratory, NMSU

Panel Members and their areas of expertise include: Dr. Raymond Bernstein (Network-Centric Warfare); Dr. Rasler Smith (Chief Engineer and Electronics Intelligence); Mr. Willis A. Janssen (Information Operations); Dr. Michael Coombs (Content-Centric Warfare); Dr. James Holded-Rhodes (Counter-Intelligence);

Who should attend: All conference participants.

Description: Focuses on topics such as information assurance in industry and government, intelligence career fields such as intelligence analysis, and strategies for surviving in the fast-changing information technology world.

"Exceptional Achievements in Creative Scholarly Activity" Faculty Presentations

Dr. Jaime Ramírez-Angulo
Klipsch School of Electrical and Computer Engineering
New Mexico State University

Microelectronics Or Where Dreams Can Become A Reality

In this presentation we will talk about the evolution of microelectronic systems starting from the invention of the bipolar transistor in the late fifties. We will describe the evolution of integrated microelectronic systems (Microchips) which obey Moore's law. This law has been in place for over thirty years. It states that the complexity of an integrated system doubles every two to three years while the physical dimensions of electronic devices are reduced by the same factor. Currently microelectronic systems can have tens of millions of transistors on a single microchip. These are used to implement complete and very sophisticated systems which could be only dreamed of a few years ago.

Anatoly Klypin
Astronomy Department
New Mexico State University

The Universe In A Box

Formation of astronomical objects is still a large puzzle. This is especially true for the whole universe. How galaxies - like our own Milky Way - formed? When the first stars formed? What happens when galaxies collide and merge? Computer models help astronomers to answer these and many other questions. Many computer animations will be shown to illustrate complex processes leading to formation of galaxies.

Paul Bosland
Department of Agronomy and Horticulture
New Mexico State University

Chiles: Even When They're Not Hot They're Cool

Everyday chiles touch our lives. We consume them, wear them, treat pain with them, and plant them in our garden for beauty. Chiles are a part of popular culture. Marketers use chiles to sell mugs, kites, clothes, clocks, houses, rock music, and the list goes on. Chileheads have their own website, magazine, and institute. Few crops have had the effect on people that chiles do. As early as 7000 B.C. the Indigenous Americans of South and Central America were growing chiles. About 500 years ago, chiles were introduced to Europe and other parts of the world following the return of Columbus from his exploration of America. Since their introduction to Europe, and their subsequent spread to Africa, and Asia, chiles have become the most consumed spice in the world, and are used in the culinary repertoire of almost every society. NMSU has had a long and illustrious history with the chile. From Fabian Garcia's development of a new type of chile the "New Mexican" pod type to the inception of The Chile Pepper Institute to "educate about the wonders of chile," NMSU leads the nation and the world in chile research and education.

Oral Presentation Abstracts

Engineering

Lawendra Atcitty, Mitchell Betonie, Patrick Yazzie
San Juan College, Farmington, New Mexico
Mentor: Eric Miller, Chemistry and Semiconductor Manufacturing Technology
Sponsored by: New Mexico Alliance For Minority Participation, NMEPSCoR, New Mexico Space Grant Consortium

Continuing Studies of the Electrochemical Deposition of Silicon onto Aluminum

Our research at San Juan College has focused on the deposition of high quality silicon at temperatures below 400 C for the production of low cost solar cells and for stacked micro or nano devices. Over the last several summers, student researchers have studied many hexafluorosilicate salt systems. This past summer, our group synthesized three tetra-alkyl ammonium hexafluorosilicate salt compounds for their feasibility as molten electrolytes for silicon. This presentation will discuss the motivation for the project, the synthesis and analysis of the compounds, and the results of the molten deposition experiments.

Jafet Gonzalez
New Mexico State University
Mentor: Adrian Hanson, Civil and Geological Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Bromide Tracer On A Full Scale Subsurface Flow Constructed Wetlands

Mesquite, New Mexico has several hundred homes where septic tank effluent is treated in a subsurface flow constructed wetland. Years of operation at this facility have caused plugging at the influent, which created a severe surfacing problem. Surfacing generates a favorable environment for odor formation and mosquito breeding, and poses a hazard to humans and animals that might come in contact with the wastewater flow. Southwest Technology Development Institute proposed an idea to introduce high strength hydrogen peroxide to the influent wastewater flow to remove the plugging in the filter media at the wetland. The flooding and head loss ceased, but returned several days later. The experiment showed promise and was repeated to insure reproducibility. Now, a Bromide tracer will be added to measure the amount of flow through the wetland to check whether sufficient water flows are going through the wetland beds. Water flow through the system varies, and cannot be seen from the surface due to the fact that this particular reactor at Mesquite is sub flow. Various tests have to be done in order to determine flow & concentration. Resulting data will help conclude if the reactor is working properly.

Sean Marquez, Jose Martinez
New Mexico State University
Mentor: Andrew Rosenthal, Southwest Technology Development Institute
Sponsored by: New Mexico Alliance For Minority Participation

Photovoltaic Array Design for the SunBurn Solar Race Car

In an effort to design, build and race a solar powered vehicle, a group of New Mexico students and professionals has formed the New Mexico College and University Solar Car Consortium (NMCUSCC). The common goal of this group is to compete in the 2003 American Solar Challenge (ASC), a 2300-mile cross-country race. ASC rules state that each car must be powered solely by the sun. To harness the sun's power, the vehicles utilize high-efficiency solar cells to convert light energy into usable electric energy. Two students at New Mexico State University have been assigned the task of designing the photovoltaic (PV) array to be used. This paper discusses basic PV solar cell operation and outlines the initial process used to design and mount the array for the New Mexico SunBurn solar racer.

Lymari Martinez
Southwest Texas State University, San Marcos, Texas
Mentor: Patrick E. Cassidy, IEIS/Chemistry
Sponsored by: NASA Space Grant

Synthesis and Characterization of a New Fluorinated Polymer

Recent demands for high performance materials in both the aerospace and microelectronics industries have provided the impetus for the development of polymers which are resistance to harsh environmental conditions. Polyethers have received considerable attention due to their outstanding combination of thermal stability and electrical and mechanical properties. A series of novel polyethers has been prepared by the reaction of 1,3-bis (1,1,1,3,3,3-hexafluoro-2-pentafluorophenylmethoxy-2-propyl) benzene with a series of bisphenols. The polymers were colorless and sustainable films were formed. These polymers were characterized by contact angle, thermal gravimetric analysis (TGA), differential scanning calorimetry (DSC), gel permeation chromatography (GPC), and inherent viscosity.

Taffy A. Miller
New Mexico State University
Mentor: Fernando Cadena, Civil and Geological Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Wastewater Treatment Using Electrochemical Systems

The purpose of this project is to learn different techniques to decontaminate wastewater from a dairy farm. Dairy farms clean their cows before milking them, and the wastewater from cleaning the cow is being monitored for this project. The wastewater is full of waste products-both dissolved and solid. This fluid will be treated by electrochemical methods, a process utilizing metal plates as electrodes. These plates will polarize and cause the fluid to move, causing hydrogen (H_2) and oxygen (O_2) gases to form from the fluid electrolysis. The electrolysis should cause an air pocket to form and should begin to mix the fluid up between the plates. The dissolved iron forms a black net mesh, which aids in coagulating the solid waste in the fluid. The black iron mesh helps with the coagulation process. The dissolved iron, the electrolysis bubbles, and the movement of the fluid produce foam like material at the top of the wastewater. This is where iron salt will continue the coagulation process within the wastewater.

The next part of the research is to compare the initial effluent samples to the treatment effluent samples of the electrochemical process by measuring the turbidity levels, pH levels, Total Suspended Solids (TSS) levels, Total Dissolved Solids (TDS) levels, and Total Solid (TS) levels. After the first twenty-minute check the turbidity levels were high. After the second twenty-minute check, the turbidity levels were at the lowest level. After the fourth twenty-minute check the turbidity levels were raising in level. This project is composed of a series of tests of wastewater at different level of voltages, amperages, and plate distances. By the end of this project it should be determined if there are sufficient ideal voltages, amperages, and plate distances, for the electrochemical treatment of the dairy waste to be environmental safe for discharge to the environment.

Jedidiah E. Roanhorse
New Mexico State University
Mentor: Richard Phillips, Project Manager, Department of Plant Sciences
Sponsored by: New Mexico Alliance For Minority Participation

Mechanical Thinning of Chile Peppers

Mechanical thinning has been implemented in crop industries for a long time and it has a potential to greatly improve in efficiency with new technology. A John Deere beet thinner was restored and modified to thin out chili peppers on the Leyendecker Research Center and Tomlin Farms in Las Cruces, NM. It was determined that the thinner worked better on thinning the chile plants when they were still small. As soon as the plants started getting taller, the sensor on the mechanical thinner couldn't differentiate between the plants that were bent over from the low clearance and the plants that were supposed to be cut. As a result, the blade arms and blades as well as the sensor were modified to certain lengths and sizes that could be adjusted to the height of the chile plants. The observations made when testing the restored mechanical thinner were used to conceive ideas for designing and developing a mechanical thinner that is both efficient and versatile. The computer program Solid Works was used to draw out the design ideas for the development of the new mechanical thinner.

Bryan R. Runyan
Mentor: David Rockstraw, Chemical Engineering
New Mexico State University
Sponsored by: New Mexico Alliance For Minority Participation

Ferrate Kinetics in Aqueous Solutions

Potassium ferrate+6 when placed in strong acids reduces rapidly to Fe+3 and oxygen. Many contaminants that are created when mine tailings are exposed to air and water can be removed by potassium ferrate+6 and in the process can form non-hazardous materials. This presentation presents a review of the oxidation rate of the potassium ferrate+6 in water and the many experiments that were done on the potassium ferrate. It will also discuss the problems with mine tailings that are left in the open, and are exposed to water and oxygen. This research will help decide whether or not potassium ferrate+6 can be used in the commercial scale.

Joey Sena, Daniel Cuba
Luna Community College
Peer Mentor: Lawrence Tafoya, Marcelina Gallegos, New Mexico Highlands University
Sponsored by: New Mexico Alliance For Minority Participation

Analog to Digital Transmitter, Digital to Analog Receiver

Digital signals are more reliable than analog signals during a transmission and will not be affected, as an analog signal will. Due to noise in the air, an analog signal will become greatly distorted. This project was implemented to demonstrate that an analog signal converted to digital could be transmitted and reconstructed back to an analog signal.

Lawrence Tafoya
New Mexico Highlands University
Mentor: Djuro Zrilic, Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Embedded Frequency Measurement System

There are many methods of measuring the frequency of a periodic electric signal. Perhaps the most popular of them today is the method found in frequency and period counters, the enumeration method. However, these methods often require a wide range of reference frequencies, which presents a problem for devices of limited resources, such as the M68EVB912B32 microprocessor. To compensate for this lack of resources, a revised enumeration method known as period averaging was utilized to allow the finished product to measure frequencies in the range of 1 Hz to 100 kHz. The interfacing circuit, or analog signal conditioner, was created in the form of a Schmitt trigger to allow good resistance to noisy signals and to prevent jitter within the input signal that would cause error within the measurement. The design of the Schmitt trigger allows for an amplitude range of input signals from 50 mV to 40 V. A linearity test was performed on the system, and the results were found to be well within an acceptable range. Finally, the maximum and minimum standardized error of the system within each range was determined.

Mathematics

Paulette Willis
Southern University at New Orleans, New Orleans, Louisiana
Mentor: Joe Omojola, Department of Mathematics and Physics
Sponsored by: Louisiana Alliance for Minority Participation

Mathematical Modeling of Investment

The purpose of this research is to study individual stocks and eventually the stock market as a whole to determine if technical indicators are a useful strategy to increase profit. Another goal of this research is to use mathematical modeling of the pattern to predict the future movement of investment vehicles. This will be accomplished primarily by calculating and graphing established technical indicators of interest. Eventually, we will explore possible combinations of strategies for synergistic effects in particular situations. It is hoped that the results of this research will provide useful information for individual, professional, and institutional investors to make profitable decisions about their investments. Furthermore, this research may encourage the belief that many things in everyday life are predictable and that math is useful to the general public.

Computer Science

Anthony Peterson
San Juan College, Farmington, New Mexico
Mentor: Doug Isley, Computer Science, Dine College, Shiprock, New Mexico
Sponsored by: New Mexico Alliance For Minority Participation

Computer Science / Information & Technologies impact on Navajo Nation's Governmental Administration.

Bridging the digital divide has been a governmental initiative signed as an executive order by former President Bill Clinton. Bill Gates has invested a tremendous amount of time and money and coined the phrase, "Bridging the Digital Divide."

I will give an oral and visual demonstration of the Computer Network set up I configured for the Teec Nos Pos Chapter Government Administration. In addition to the elaborate Intranet development and design that I created for their LAN (local area network), I will also be featuring some developments in GIS (geographic information systems) that I have setup for community land use planning and development. I will be presenting and demonstrating how my technological disciplines of computer science have greatly improved the administrative overhead for a local community government. Bridging the digital divide is about bringing rural sociologically repressed communities up to the forefront of the new millennium of Internet and Computer Technology.

I have worked this past summer of 2002 with my local community government, as part of my cooperative educational credit hours towards my Associates of Applied Science in Computer Networking and A.S. in Computer Science.

Javier Rodriguez, Michelle Villa, Adrian Godina
New Mexico State University
Mentor: Rudi Schoenmackers, Southwest Technology Development Institute
Sponsored by: New Mexico Alliance For Minority Participation

Wireless Internet Access for New Mexico State University's Educational Community

The faculty, staff and students at New Mexico State University face the same dilemmas as those at other college campuses with stress from multiple tasks and time constraints. The ability to have wireless Internet access would allow for greater retrieval speed and freedom to be mobile, thus making teaching, job duties and studying more efficient. This project of wireless networking focuses on the ability to make wireless Internet access a reality with the use of an 802.11B local area network (LAN) signal from a NMSU rooftop to the top of "A" mountain and back to the surrounding community of Las Cruces and NMSU, a distance of 3.2 miles. Wireless Internet connections have been achieved on the NMSU campus and surrounding Las Cruces area. The ultimate goal is to produce a permanent wireless Internet service for the NMSU community.

Life Science

Roberta Diswood
San Juan College, Farmington, New Mexico
Mentor: Don Hyder, Callie Vanderbilt, Biology
Sponsored by: New Mexico Alliance For Minority Participation

The Study of Gunnison Prairie Dog Habitat

The study of determining potential Gunnison prairie dog habitat from topographical maps was found that they prefer specific plants, altitudes and minimal incline in the grassland regions they inhabitant. The study only included BLM (Bureau of Land Management) land, our findings may be somewhat limited. The prairie dogs pose themselves as a pivotal species in the daunting habitats of the New Mexico grasslands and mesas. They provide shelter with their abandoned and even occupied burrows to burrowing owls, lizards, rattlesnakes, spiders and various insects. They seem to be a major food source for any and all of the resident carnivores especially coyotes and birds of prey. In the quad regions of study there were ample wash areas that met the requirements for vegetation, and lack of slope. However, there areas have been deemed unsuitable for habitation due to intermittent flooding. The current drought situation the region is experiencing had made the prairie dogs somewhat inactive and in better weather our findings would undoubtedly change.

Shonette Matthews
Southern University of New Orleans, New Orleans, Louisiana
Mentor: Murty S. Kambhampati, Biology
Sponsored by: Louisiana Alliance for Minority Participation

Accumulation of Copper in Grass Shrimp (Palaemonetes pugio)

Accumulation of copper, a trace metal, in Palaemonetes pugio (grass shrimp) was investigated at LUMCON during the summer of 2002. P. pugio also named as hardbacks (50mm in length) are classified under the phylum Arthropoda. They are extremely excellent scavengers, helping to maintain the breakdown of detritus. The goal of this research was to determine copper accumulation in the grass shrimp. Test medium (salt water) was analyzed for dissolved oxygen, pH, and salinity. Adult grass shrimp were obtained from a local pet store and were acclimated for at least 36 hours in an aquarium, filled with ultra violet treated seawater, provided by LUMCON. Grass shrimp were exposed for different concentrations of copper (0.1, 0.5, 1.0, 5.0, and 10 ppm) as cupric sulfate for a period of 3, 6, 12, 24, and 48 hours at 10 and 20 ppt salinity. We had two replicates for each treatment and three subjects per treatment. Subjects were exposed to 50mL medium in each treatment in specimen bowls. Subjects were dried in an oven at 700C for 36-48 hours. Samples were analyzed for copper using Inductively Coupled Plasma Spectrometer (EPA method). The maximum copper was recorded at 48 hours exposure 194.940.56 ppm at 5 ppm and 214.870.74 ppm at 0.5 ppm in 10 and 20 ppt salinity respectively. However, we did not find any consistent trend in copper accumulation in the tissues of the subjects.

Laura Pauline
Southern University of New Orleans, New Orleans, Louisiana
Mentor: Murty S. Kambhampati, Biology
Sponsored by: Louisiana Alliance for Minority Participation

Accumulation of Cadmium in Grass Shrimp (Palaemonetes pugio)

Accumulation of cadmium in Palaemonetes pugio (grass shrimp) was investigated at the LUMCON during the summer 2002. P. pugio, widely distributed in aquatic bodies, are classified under the phylum Arthropoda. The goal of this research was to determine cadmium accumulation in the grass shrimp. Test medium (salt water) was analyzed for dissolved oxygen, pH, and salinity. Adult grass shrimp were obtained from a local pet store and were acclimated for at least 36 hours in an aquarium filled with ultra violet treated seawater provided by the LUMCON. We exposed grass shrimp for different concentrations of cadmium (0.1, 0.5, 1.0, 5.0, and 10 ppm) as cadmium nitrate for a period of 3, 6, 12, 24, and 48 hours at 10 and 20 ppt salinity. We had two replicates for each treatment and three subjects per treatment. Subjects were exposed to 50mL medium in each treatment in specimen bowls. Subjects were dried in an oven at 700C for 36-48 hours. Samples were analyzed for cadmium using Inductively Coupled Plasma Spectrometer (EPA method). A consistent increase in cadmium concentrations in the tissues corresponding to the exposure time was observed both in 10 and 20 ppt salinity media. Maximum accumulation of cadmium was recorded at 48 hours exposure 490.223.04 ppm and 157.50.64 ppm at 10 ppm in 10 and 20 ppt salinity respectively.

Physical Science

Jose Leo Banuelos
New Mexico State University
Mentor: Stephen Kanim, Physics
Sponsored by: New Mexico Alliance For Minority Participation

Optimization of a Horizontal Pendulum for Seismic Studies

The Zllner design horizontal pendulum may be used to obtain seismic data and estimate the magnitude of an earthquake. Several mathematical models exist to describe the magnitude of an earthquake. However, some of these models work with parameters that may underestimate the correct magnitude of an earthquake. By optimizing the horizontal pendulum to measure earthquakes with the precision and accuracy of today's modern detectors, data can be collected and applied in hopes of making a contribution to current methods in seismic analysis. This project's current research focuses on improving the horizontal pendulum's data acquisition, analysis, and storage capabilities. The addition of a computer to record data and use of DataStudio software for analysis will be discussed. Newly recorded data will be presented along with a rough analysis using fast fourier transform methods. Also, new insight into the frequency response characteristics of the horizontal pendulum will be briefly presented.

Mario Borunda
University of Texas at El Paso, El Paso, Texas
Mentor: Jorge Lopez, Department of Physics
Sponsored by: University of Texas System Alliance for Minority Participation

Recoil Spectrometry Analysis of Hydrogen Evolution in Thermally Processed Gate Dielectrics

Recoil Spectrometry (Elastic recoil detection analysis) is traditionally used for hydrogen analysis at energies that range from 2 to 2.5 MeV 4He+ beam with a 10 mm aluminum or Mylar absorber. The resulting depth resolution is about 70 nm in Silicon. The depth resolution depends on the energy resolution of the experimental setup, the energy loss straggling in the Mylar absorber and the stopping power in the material to be analyzed, in this case hafnium silicate gate dielectrics. With electronic devices shrinking in size, gate dielectric thicknesses are in the tens of nanometers. Better depth resolution is thus necessary for hydrogen analysis in ultra-thin gate dielectrics. This study was used to 1) evaluate and optimize the depth resolution, and 2) to determine the hydrogen incorporation (passivation) in hafnium gate dielectrics/silicon structures.

Shaquetta Stovall
Southern University at New Orleans, New Orleans, Louisiana
Mentor: Carl Johnson, Chemistry
Sponsored by: Louisiana Alliance for Minority Participation

Reconstituting Tissue Factor into Phospholipids

Blood is a major component of the human body. Without blood no mammal would be able to remain alive. This is the reason why blood coagulation, the ability to clot blood, is a vital key to survival. Blood coagulation is the process of converting liquid blood into a solid or gel state. The process of blood coagulation usually begins when a blood vessel becomes injured. Plasma, the liquid part of blood, is then exposed to the exterior of the phospholipid bilayer. When this occurs, a cascade begins that start the coagulation process. My project entails the initial stages of this process, which is the formation of the tissue factor - factor viia complex on phospholipid surfaces. Tissue factor is the cell-surface protein that binds factor vii. Factor viia, the activated form of factor vii, is a plasma serine proteinase responsible for initiating blood clotting via the extrinsic pathway. My research involved two major components: (1) what types of tissue factor and phospholipid ratios can achieve the best and most constant clotting times and (2) understanding how tissue factor and factor vii bind on the surface of the phospholipid bilayer and to each other.

Joseph Tarwoe
Southern University at New Orleans, New Orleans, Louisiana
Mentor: Joe Omojola, Mathematics and Physics
Sponsored by: Louisiana Alliance for Minority Participation

High Pressure Studies on c60 Ffullerene Synthesis of a Superhard Material using Designer Diamond Anvil Cell

High pressure studies were carried out on c60 fullerene (99.95% purity) in a diamond anvil cell up to 40 gpa at room temperature. The c60 sample was compressed to a given pressure in a diamond anvil cell using ruby fluorescence as a pressure sensor. The sample was then decompressed and removed from the diamond anvil cell for hardness measurements. Nine experiments were performed between 0 and 40 gpa at room temperature. Hardness measurements indicate that the recovered sample has a hardness of about 40% that of diamond after pressurization to 40 gpa. The practical applications of this material under high pressure will be discussed.

Poster Presentation Abstracts

Engineering

Jose Chacon
New Mexico State University
Mentor: Kenny Stevens, Civil and Geological Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Increasing Papercrete Block Strength to Compete with Standard Adobe

This study looked at the structural properties of a concrete product made of waste (recycled) paper, sand, Portland cement and water, called Papercrete. The objective was to increase the strength of the papercrete block similar to that of a Standard Adobe block. The standard adobe blocks that are commonly used today have a compressive strength of about 300 pounds per square inches (psi), whereas the compressive strength of papercrete is around 90 psi. To increase the strength of papercrete, many samples were made with different proportions of the admixtures. With each succeeding batch, one of the ingredients was increased. Each batch produced 4-5 samples of a particular mix. The three primary materials that were increased were: paper, sand, and used motor-oil. The papercrete blocks were allowed to dry/cure for fourteen days, as are adobe blocks, before any kind of testing was done.

The specific tests conducted were: compressive strength, the modulus of rupture, water absorption and the water content. As expected, the compressive strength of the papercrete rose immensely as the amount of sand was increased, but the modulus of rupture decreased. When paper was added to the batches, the modulus of rupture strength rose, while the compressive strength went down. In the oil added batches, the compressive strength rose steadily, while the modulus of rupture showed little or no change. It was not until the last batches that favorable results were obtained from the tests. Here the compressive strength and modulus of rupture rose dramatically. The compressive strength reached over 300 psi and the modulus of rupture above 50 psi.

Raymond dela Vega
New Mexico State University
Mentor: Zorhab Samani, Civil and Geological Engineering
Sponsored by: New Mexico Alliance for Minority Participation

Energy Production from Cotton Gin Waste Using Two-phase Anaerobic Digestion

Cotton gin waste (CGW) presents a major problem for the cotton ginning industry. Approximately 2.8 million tons CGW is being produced each year across the cotton belt of the United States (Thomasson et al, 1998). Despite extensive research efforts, very few uses for CGW have ever reached widespread commercial acceptance and CGW remains a financial liability for most producers (Castleberry and Elam, 1999). Wastes from the process of ginning cotton currently are not being utilized to their full potential. There is a need for processes that can utilize the waste produced every year from cotton gins. At New Mexico State University researchers are currently developing a two-phase pilot-scale bio-fermenting process which utilizes naturally occurring enzymes in cow manure to break down the complex structure of cotton wastes. The two phases each perform a different process in the digestion. The first-phase (digester) breaks down the manure and the cotton wastes producing a leachate that includes volatile fatty acids (VFA) which are used by the second phase methane producing bacteria to produce methane. Results have shown that this process has been successful with more test runs to come in the future. Further we have discovered that the utilization of cow manure as a type of catalyst in the digestion process is useful to material other than cotton gin wastes. Running of prior tests using paper we found that when cow manure is not used in the digester that the paper material did not break down, however when combined with cow manure the break down was relatively quick.

Sonia Espinosa, Carlos Valdez
New Mexico State University
Mentor: Anthony Hyde, Engineering Technology
Sponsored by: New Mexico Alliance For Minority Participation

Study of a Computer Vision Based System for Red Chile Detection

The purpose of this project is to identify and implement ways to keep chile production profitable in New Mexico. Since red chile harvesting is costly due to high labor costs, chile harvesting is steadily declining in New Mexico. Hand harvesting accounts for approximately 50% of the labor costs; mechanical harvesting is a key to the survival of harvesting industry. This research project is being conducted in collaboration with New Mexico Chile Pepper Task Force in which their mission is "To identify and implement ways to keep chile pepper production profitable in New Mexico." Some mechanical designs have been developed within the NMSU M-TEC program, but have been unsuccessful in separating red chile from unwanted objects. We will be researching various ideas to begin designing and implementing a computer vision based system, which will be used to assist chile harvesters in separating useable products from undesirable objects. Currently computer vision is a highly resourceful tool within industrial businesses. A typical computer vision system used in a factory consists of a video camera positioned above the production line. The camera captures an image of the specified object and sends it to the computer. An analysis of the image is made and it is determined if the object is within the predetermined specifications. Once detected, a mechanical device is activated to remove the object. This process is repeated for each object in the production line. Computer vision has taken the place of manual inspection in many situations. In the chile harvesting process, computer vision is a desirable tool, which may be used to decrease production time as well as reduce labor costs.

Mesfin Getaneh. Assaft Abdo
University of New Orleans, New Orleans, Louisiana
Mentor: Puri Ashok, Physics
Sponsored by: Louisiana Alliance for Minority Participation

Laser Doppler Velocimetry using Michelson's Interferometer

A Laser Doppler Velocimetry (LDV) technique using a Michelson's Interferometer was developed in this project. In conventional LDA techniques, two coherent laser beams are made to intersect in the measuring volume. By shifting the optical frequencies of one of the beams or by using different colored lasers, one can measure the flow reversal. The technique that has been developed simultaneously measures the speed of the fluid flow and determines its direction for a single color laser beam by using a Michelson's Interferometer (MI). Using a MI and lenses generated parallel fringes that were perpendicular to the direction of the flow. The particles in the fluid scatter light of different intensity while moving the measuring volume. Then a photo detector picked up some scattered lights. The resulting frequency of the photo detector output is related directly to the particle velocity. By shifting the mobile arm of the MI, the fringe can be moved along or against the flow direction. A higher Doppler shifted frequency is observed when the fringes travel against the direction of flow and vise-versa, thus enabling us to distinguish between the directions.

Marco Gonzalez
New Mexico State University
Mentor: Andrew Rosenthal, Southwest Technology Development Institute
Sponsored by: New Mexico Alliance For Minority Participation

Mockup Of Solar Car Chassis

New Mexico SunBurn Racing is a joint project undertaken by New Mexico State University, University of New Mexico, and Albuquerque TVI. This project is under the New Mexico College and University Solar Car Consortium (NMCUSCC) and the Department of Energy (DOE). The goal of SunBurn Racing is to design and build a solar powered vehicle and race it in the American Solar Challenge (ASC) competition held June 2003.

The SunBurn Racing solar car project is a non-profit organization that consists of members who come from across all academic disciplines and experience levels. Fully operated by teams of undergraduate students from New Mexico colleges and universities, the ultimate goal of Sun Burn Racing is to design and build a solar car to participate in the 2003 American Solar Challenge (ASC) competition. The ASC is a 10-day cross-country race in which the students will have an opportunity to display their skills in this national event. The students involved in SunBurn Racing are developing leadership skills and gaining practical experience not usually possible in a classroom setting. The team members will represent the state of New Mexico and will learn valuable real-life lessons in the application of technology and business practices through the design, fabrication, and financing of a solar-electric vehicle. With an aim of educating the public about the potential of alternative energy resources and engineering excellence our team has looked forward to challenging ourselves to develop the best team and solar powered vehicle.

Frank Juarado III
New Mexico State University
Mentor: Fernando F. Cadena, Civil and Geological Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Removal of Arsenic from Drinking Water: Kinetic Studies and Optimization

Arsenic found in drinking water is a growing concern in today's world. The focus of this presentation will be on the research concerning the use a chemical known as akaganeite (AKAG) for the remediation of arsenic from water. Studies were conducted on the behavior of AKAG for the purposes of experimental modeling and application towards process optimization. Preliminary results demonstrate that under very acidic conditions, high AKAG mass, and medium-range residence time (2-6 hours) constitute effective removal of arsenic to below EPA standards. High pH concentrations are ineffective and result in no arsenic remediation. Optimum conditions arise at near neutral pH conditions and relatively short treatment times.

Juan Lozoya
New Mexico State University
Mentor: Khaled Sobhan, Civil and Geological Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Understanding the Effects of Geo-Grid Placement On Reflective Cracking in AC Overlays

The purpose of this research is to determine if the placement of a geo-grid in asphalt overlays over concrete pavements will decrease the rate of propagation of reflection cracks. A geo-grid can be described as a biaxial plastic grid that will be placed inside the asphalt layer to reinforce the material against cracking. The experimental program utilizes an asphalt beam (18"x 6" x 3"), two pieces of plywood (9" x 6" x 3") and a rubber foundation to model the overlay system. The plywood is bound to the asphalt beam with an asphalt binder, with a 1 cm gap between each of the plywood pieces to model joints in the concrete pavement. The rubber foundation represents the soil beneath the concrete roadway and the asphalt. A cyclic test was conducted using an MTS servohydrolic machine to simulate a car passing over the crack. The experiment consisted of three different beams that need to be tested: (1) an un-reinforced test without a geo-grid in the beam; (2) a reinforced test with the geo-grid placed at the bottom of the beam, and (3) a reinforced test with the geo-grid placed in the middle of the beam. The beams used in this experiment were created in a steel mold (18" x 6" x 6"), compacted with a roller and compressed with a steel plate placed on top of the beam, which was hammered with a rubber mallet. The experimental results showed that the beam with the geo-grid in the middle either prevented or significantly slowed down the reflection cracks from reaching the surface of the beam. Therefore the use of geo-grids can be an effective and economical method for the rehabilitation of existing pavements.

Brandon D. Madrid
New Mexico State University
Mentor: N. Khandan, Civil and Geological Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Educational Materials Development

The objective of this project is to develop a repertoire of educational materials to cater to a mix of learning styles of undergraduate engineering students. This repertoire will include computer-based lecture support notes, tutoring modules, simulation models, and assessment tools; physical demonstration devices; and a compilation of unique fallacies, riddles, and problems. Some materials will be for in-class use, some for out-of-class use, and some a combination of the two; some are for group use, while others are intended for individual use. It is anticipated that these tools will optimize teaching efforts and improve student achievement by stimulating critical thinking, cultivating problem-solving skills, and enhancing the learning experience through increased student-faculty and student-student interactions. The materials will be targeted toward undergraduates at the junior/senior level in the fields of civil, mechanical, and chemical engineering, pursuing engineering or technology degrees.

Nicholas Marckstadt
New Mexico State University
Mentor: Ed Conley, Mechanical Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Greater Trochanter Role in the stability of Trochantric Fractures

The purpose of this research is to study the effects of the trochanter muscle on the femur. Many universities have already tested and recorded the fatigue and strength measurements of the femur from the head and knee connection area but have not taken into consideration the possible role that the trochanter plays. We are using the instrong machine to mimic the forces applied by the human torso on the head and are also mimicking the trochanter. We are reviewing previously completed research in hope of finding that the trochanter will give us different and more accurate readings of the strength and deflection values of the femur. We are anticipating that the trochanter plays a crucial role in the strength and force distribution of the femur and with this new data we can hopefully get funded to use real femurs and work on building stronger and longer-lasting prosthesis for fractured femur patients.

William Montoya
New Mexico State University
Mentor: C.I. Ricketts, Engineering Technology
Sponsored by: New Mexico Alliance For Minority Participation

Venturi Effect Demonstration Device

National Science Foundation is sponsoring the production of classroom demonstration devices at New Mexico State University under the guidance of faculty members in Engineering Technology and Civil engineering. The objective of this project is to develop a device that will demonstrate the Venturi Effect and implement the fundamental principle of the Bernoulli Equation. The new device will enhance textbook, laboratory activities, class lectures, and video films as a learning aide.

Isaiah K. Storey
New Mexico Institute of Mining and Technology, Socorro, New Mexico
Mentor: Siddharth Pandey, Department of Chemistry, New Mexico Institute of Mining and Technology
Sponsored by: New Mexico Alliance For Minority Participation

Analytical Report on Room Temperature Ionic Liquids: Applications and Properties

Ionic liquids are a new form of reaction media that has been introduced within the last decade. For years, the chemical industry has been synthesizing chemicals by using organic solvents as their reaction media. Organic solvents are a good reaction medium, except that they are extremely volatile, detrimental to the environment and hazardous to those who work with them. That is why ionic liquids are the next wave in chemical synthesis. These liquids offer a cleaner and more efficient means of synthesizing chemicals. Ionic liquids are structurally similar to that of common everyday table salt and no hazardous health effects. They have numerous applications that range from the production of oil and natural gas to the synthesis of various pharmaceutical drugs. However, little information is known about these chemicals and more research must be done before they can be a viable means of carrying out chemical reactions. We plan on investigating some of their properties through fluorescence spectroscopy, as well as ultra-violet-visible light spectrophotometry. It is our intent to investigate their properties relative to other solvents that are currently used in industry. It is crucial to attain more information on their properties so general conclusions can be made about the synthesis of chemicals in ionic liquids.

Carmen R. Torres
New Mexico State University
Mentor: Ron Polka, Southwest Technology Development Institute
Sponsored by: New Mexico Alliance For Minority Participation

The Development and Testing of a Solar Oven

Poverty is a major issue in third world countries especially when their most common cooking fuel is wood. Collecting wood not only requires a lot of time and effort but also has high prevalence of respiratory and eye diseases amongst women. Researchers have now developed solar ovens that can cook your meal in just a matter of hours. A prototype solar oven was tested at New Mexico State University with the sole purpose to find out if in fact, the oven proved to be effective and efficient for these countries, but results showed otherwise. The task is to modify the oven by minimizing heat loss and maximizing heat gain. However restrictions apply, glass and mirrors are hard to obtain and too costly therefore must not be used. Once the oven is complete, a side-by-side test of the prototype and modified oven will be conducted. The test will be conducted with the use and restrictions of the Testing and Reporting Solar Cooker Performance guide. For example when leading the experiment the winds must not exceed 1.0 ms^-1 and ambient temperatures must be between 20 and 35°C. Precautionary measures will be taken in order to meet all requirements and obey all guidelines and restrictions.

Yvonne Torres
New Mexico State University
Mentor: Stephen Kanim, Department of Physics
Sponsored by: New Mexico Alliance For Minority Participation

Drumhead Resonant Modes

Different forms of frequencies play an extremely important role in our lives today. Each day we experience some form of wave whether it is radio waves being picked from our radio or light waves traveling from distant stars. The military uses sound waves to detect suspicious incomers above and below ground and police officers use lasers, light waves, to detect the frequencies at which you are traveling. The drumhead demonstrator helps us to visualize sound waves produced at certain frequencies. The frequencies obtained are from our famous Bessel function. The Bessel function gives us the exact frequencies we need in order to visualize a specific sound wave on the drumhead. The advantage of visualizing the behavior of sound waves increases our ability to understand how they are produced. Each sound wave travels at a certain frequency, defined by the number of times that a periodic process occurs in a unit of time, in other words, the number of vibrations per second. The drumhead demonstrator is used to help understand the behavior of sound waves. The Alliance for Minority Participationlifier, which is what is used to drive the speaker, combined with the audio oscillator, which sets the frequency, gives the drumhead just the right frequency in order for us to see the motion of the wave. To see the motion even more clearly, a stroboscope is used to match the frequency in which the drumhead is vibrating. With the matching frequencies, a perfect frozen picture of how the cycles of the wave are traveling is obtained.

Luis Vasquez
New Mexico State University
Mentor: Russell P. Jedlicka, Electrical and Computer Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Reduced Size Microstrip Antennas

The goal of this project is to investigate the possibility of reducing the size of microstrip antennas. The work of Johnna Powell and David Brumit at NMSU has shown that it is possible to achieve significant reductions in antenna size. The cost of reducing the size is that the efficiency of the antenna goes down correspondingly. This project is trying to minimize the degradation of efficiency. It is hypothesized that integrating a 90 degree hybrid patch will accomplish this goal. Previous work at NMSU has produced antenna configurations that have achieved size reductions ranging from 28 to 67%; these units are named TC_X1, Curl, and Swirl. While the hybrid patch will be larger than the previous antennas (correspondingly smaller size reduction factor) it is hypothesized that it will have a larger bandwidth and enhanced efficiency. To test this theory measurements have been run on a folded 90 degree hybrid, which will be incorporated into the antenna structure to improve the impedance and polarization properties.

Mathematics

Juana de Smet
University of Texas at El Paso, El Paso, Texas
Mentor: Hamide Dogan-Dunlap, Department of Mathematics
Sponsored by: University of Texas System Alliance for Minority Participation

Concept Maps in Mathematics: with Emphasis on Slope

This investigation was implemented during the summer of 2002 in college level Mathematics courses. The purpose of this study was to examine the possible correlations between concept maps and student success rates. This particular concept map involves a central theme and two traits. The concept maps are developed by students and analyzed in the three ways. Data was collected from two courses, which used the same methods of instruction, a total of three times through out the course. Two claims supported by this research are that (1) the success rate is determined by the percentage of maintained initial relations and (2) low success rates are reflected by the dominating attribute of new additions. Overall, findings suggest a strong correlation with concept maps and student success rates, also implied is the validity of concept maps as assessment tools supporting traditional methods for student learning/achievements in mathematics.

Computer Science

Carl-Frederic Bastien
City University of New York—City College, New York, New York
Mentor: Robert Alfano, Institute of Ultra-fast Spectroscopy and Lasers (IUSL)
Sponsored by: New York City Alliance for Minority Participation

Optical Tomographic Image Reconstruction For Breast Cancer Detection

Optical tomography is being developed as an alternative method to x-ray mammography in order to screen for cancer in the human body. The development of a non-invasive method for cancer detection will require an algorithm capable of reading the inside of the body for abnormalities. By using laser beams, multiple detectors, and with the aid of a computer, we can recreate the internal structure of a human body part and screen the interior for tumors. This method will not involve any invasive surgical procedures or exposure to potentially innocuous x-rays as is the case in the current modality, namely mammography. The data collected from the harmless procedure will then be stored in a Tag Image File Format (TIFF). The TIFF format is one of the most versatile and diverse bitmap format in existence. Although TIFF has garnered a reputation for power and flexibility, it is also considered complicated and confusing in its design. This complexity is in part due to the way the data is stored in the TIFF file. The proposed algorithm that allows for the extraction of all forms of data from the TIFF file follows the specifications of the logical organization of information in a TIFF specification. Such an algorithm will also be enhanced as a direct result of this research endeavor. After the data collection an inverse algorithm will be developed to reconstruct the original image for further analysis.

Mark Carpenay
City University of New York—Queens College, New York, New York
Mentor: Kenneth Lord, Computer Science
Sponsored by: New York City Alliance for Minority Participation

Probabilistic Models for Motifs: Human Donor Splice Site

The goal of our project was to implement a probabilistic model for finding motifs in the human donor 5' splice site. The splice site was defined as a 9 base window around the position where splicing occurs, consisting of 3 bases from the exon and 6 bases from the intron.
Candidate splice sites were denoted by b and if the site consisted of k bases, we denoted these bases as $b_1 \ldots b_k$. For our 5' splice site, k was equal to 9. We predicted if a candidate site $b_1 \ldots b_k$ was a 5' splice or not by building two different probabilistic models:

1) The "Splice Model": which defined the probability distribution over real 5' splice sites.
2) The "Null Model": which was defined to model all sites in the genome that were not 5' splice sites.

Thus given candidate site b, $P(b|M_{splice})$ denotes the probability of the site b under the splice model and $P(b|M_{null})$ denotes the probability of b under the null model.
The likelihood ratio was calculated using:
$P(b|M_{splice})/P(b|M_{null})$
The log of the likelihood ratio which is often called the score was used as our primary statistic (i.e. score $(b) = log(P(b|M_{splice})/P(b|M_{null}))$) and assuming that all nucleotides in the sequence were independent of each other, we got

$P(b|M_{splice}) = (p^1_{b1})\ (p^2_{b2})\ ..\ (p^9_{b9})$
Where p^i_x was the probability of seeing character x in position i. in a splice site,
x =A,G,C,T and i. = 1...9.
We then used a training data set of real human donor sites to build our M_{splice} model to estimate the parameters p^i_x to produce a "weight matrix ". This was later used to score candidate splice sites b. However, since our training data set was small arbitrary small pseudocounts were also used in calculating our "weight matrix".
In creating our null Model M_{null} we considered an equal probability of each nucleotide in the sequence occurring. Thus p^i_x for the null model was assumed to be equal for all x in positions i. (i.e. $p^i_x = \_$ for all x = A,G,C,T and all i.= 1...9)
We then used the M_{splice} splice model that was constructed from training data to test whether the log likelihood score would help us discriminate between true donor splice sites and non-splice sites. This was done by testing the model using a " positive test set " of true donor splice sites and a "negative test set " of non- splice sites

Joshua Jowers
Eastern New Mexico University, Portales, New Mexico
Mentor: Tom Brown, Department of Mathematics
Sponsored by: New Mexico Alliance For Minority Participation

Comparison of Serial and Parallel Integer Addition

Many important computational problems require computer systems capable of computational speeds that exceed the speeds of the fastest serial computers. Parallel programming is a way to realize increased computational speeds for some of these computationally intensive problems. By performing computations on more than one computer in parallel, overall computation time may be reduced.

To illustrate the speed tradeoffs between serial and parallel computation, the mathematical operation of adding an array of integers was programmed on an eight-node Rocks Cluster. By analyzing the timing of the parallel addition, the analysis shows that the runtime is dependant on two factors, communication and computation speeds. The communication time includes time to package the array (latency time) and the time to send and receive the array (message-passing time) using Message Passing Interface (MPI) commands. The computation time to add an array of integers is determined solely by the speed of the processor. The theoretical execution times are analyzed using the time complexity of the algorithms and timing statements embedded in the serial and parallel programs. Through analysis, the time complexity of serial addition is O(n) and the time complexity of the parallel addition is O(n+m) where n is the length of the integer array and m is the number of processors. Finally, the theoretical expressions were compared with the simulation-based timing results.

In conclusion it is not appropriate to add integers in parallel on the Rocks Cluster since the serial execution time is less than the parallel execution regardless of n and m. The process of comparing serial and parallel timings is essential to parallel programmers because it defines whether or not the program serves it purpose; to be faster than a serial program.

Kpade Viho
City University of New York—Borough of Manhattan Community College, New York, New York
Mentor: Nkechi Agwu, Department of Mathematics
Sponsored by: New York City Alliance for Minority Participation

Interactive Links to Related Areas of the Mancala Game

The ultimate goal of the project is to develop a computerized Mancala game on a website that will allow users to play the game at a desired level and keep a scoring system, to provide a help facility where users can learn to play, and to link the facility to its subject related areas like mathematics, art, history. Under the direction of the faculty mentor, the project focused this summer on researching the didactic aspects of the game. The areas of mathematics, history and art have been explored and condensed into web pages with interactive links to the game board previously designed during the spring. The researcher assistant designed a master homepage for the project to be uploaded on a web-server. A request has been submitted to the AMP office to include the project as a link on the Planet-AMP website. Further details are expected by the end of the summer. The August 13th 2002 Joint Statistical Meetings allowed me, along with my mentor to revise the appropriate ness of data mining and focus on the theory of genetic algorithm. Meanwhile I have proceeded to the successful testing and debugging of the beta version of the computerized Mancala. I plan to complete the project by Fall 2002 by modeling two new levels of complexity in the game: intermediate and expert with mathematical algorithms of successful strategic response, and also to provide a help facility where users can learn how to play.

Life Science

Heriberto Cuellar
New Mexico State University
Mentor: Graciela A. Unguez, Department of Biology
Sponsored by: New Mexico Alliance for Minority Participation

Detection of MyoD and Myogenin in the tail of Sternopygus macrurus.

The changes in gene expression that occur during the phenotypic conversion of skeletal muscle to electric organ (EO) in electric fish are not known. What is known about this conversion (muscle to EO) is that these two myogenically-derived cell types differ in their biochemical, morphological and functional properties. Skeletal muscle contains the sarcomeric proteins that allow it to contract, whereas the cells of the EO do not. Further, skeletal muscle cells are active intermittently while cells of the EO discharge continuously and at higher frequencies. The purpose of this experiment is to determine whether or not changes in cell phenotype are associated with changes in the expression of the MyoD family of transcription factors. Changes in expression of MyoD and myogenin, two members of the MyoD family, will be determined using in situ hybridization, a technique that detects mRNAs on tissue sections. Specifically, we will determine the tissue location and stage at which these two myogenic transcription factors are expressed during regeneration of muscle and EO. We hypothesize that changes in the expression of MyoD and myogenin occur during the process of muscle to EO conversion.

Gary Darrington
New Mexico Highlands University, Las Vegas, New Mexico
Mentor: David Hacker, Natural Resources Management
Sponsored by: New Mexico Alliance For Minority Participation

Effects of Rocky Mountain Elk on the Rio Chama Water Shed

Rocky Mountain elk (cervus elaphus c. nelsoni) populations in northern New Mexico have risen substantially over the last five years. Elk populations have been increasing for quite some time but it was not until recently that foresters and ranchers have observed the huge impacts they may be on the land. In the past few years, New Mexico has received very little precipitation. The lack of moisture has hurt the normal elk ranges. Elk have been forced to move to new places to find sufficient forage. Most often, these places tend to be privately owned ranches. Ranchers depend on their land to support their cattle. Elk herds are increasing rapidly so new and more efficient management plans need to be developed.

Elk breed in September or October and carrier their young through the winter, with a 248 to 255-day gestation period. Calving takes place from mid April through June. Cow elk start breeding at 15 to 16 months. Cows usually give birth to only one calf and the sex ratio is close to 50-50. Calf mortality rates range from 5% to 15% depending on the climate, feed, predators, and sport hunting. Mortality of bull calves is slightly greater than females. A female elk has a reproductive period from 12 to 20 years.

In March 2001, five plots with an area of fifty square feet (4.6 square meters) were constructed in the Gallina Mountain Allotment of the Santa Fe National Forest. The plots were fenced off so that elk and cattle could not remove the vegetation. Cattle graze this allotment from mid May through early October. In October 2001,after the cattle had been removed, the plots were clipped, samples dried and weighed. For every closed plot, there was an open plot. The clippings were then used to determine to what extent elk and cattle graze the forest. Cattle and wildlife grazed 38% of the forage in the Gallina Mountain Allotment during the 2001 summer.

Joanne Gonzalez
Southwestern Oklahoma State University, Weatherford, Oklahoma
Mentor: John D. Ash, Dean A. McGee Eye Institute
Sponsored by: Oklahoma Alliance for Minority Participation

Microarray Analysis of Mouse Retinas with tgf-b1 Inhibited Vascular Development

Neovascularization in the eye causes severe visual impartment in a number of diseases. Proliferative Retinopathy is characterized by abnormal vessel growth out of the retina. Animal studies have shown that transforming growth factor beta 1 (TGF-_1) can inhibit retinal angiogenesis. Our goal is to study the mechanism(s) responsible for suppressing retinal vascular development in transgenic mice expressing TGF-_1. Retinal RNA was isolated from two lines of transgenic mice expressing TGF-_1. It has been reported that line 920A has higher levels of expression compared to line 853, which results in a more severe phenotype.

Tiffany Gary
Voorhees College, Denmark, South Carolina
Mentor: Albert Abbot, Department of Biological Sciences, Clemson University
Sponsored by: South Carolina Alliance for Minority Participation

Synthetic Spider Silk Protein Production and Purification

Spider silk has outstanding strength and elasticity. For years scientists have tried to duplicate this fiber to make marketable materials such as sutures and bulletproof vests. This project engineered an artificial protein sequence that mimics that of Golden Orb Spider's dragline silk. My work had two components: (1) protein production, using techniques such as inoculation, incubation, centrifugation, dialysis, immunoblotting, and coomassie blue staining, and (2) protein purification using a barch/gravity flow column. It was determined that we had successfully produced the desired spidroin-2-like protein, which is to be used for fiber spinning and coating.

Sawanda Langston
Voorhees College, Denmark, South Carolina
Mentor: Arthur Hinton, U.S. Department of Agriculture, Department of Microbiology
Sponsored by: South Carolina Alliance for Minority Participation

Effect of Storage Temperature on Bacterial Populations on Processed Broiler Carcasses

Bacteria found on poultry carcass may cause carcass spoilage and human foodborne diseases. The temperature at which the carcasses are stored plays a major role determining the number and types of bacteria that can grow on the carcasses. In the present study, the effect of storage temperature on the growth of different types of bacteria that are normally found on processed chickens was examined. Carcasses were obtained from a local poultry processing plant, placed on ice, and transported to the laboratory for analysis and storage. Carcasses were stored at 4°C and 22°C; and a bacterial analyses made from the carcasses by shaking the carcasses in a plastic bag containing 100 ml of 0.1% peptone water for 1 min. Bacteria in the rinsates were enumerated on the appropriate selective or non-selective agar. Carcasses were examined for the following bacteria: Pseudomonas sp., Escherichia coli, Campylobacter sp., Staphylococcus sp., and total aerobes. Findings indicate that the temperature at which fresh poultry is stored will affect the numbers and types of bacteria that grow on the carcass during storage. Therefore, it is important to store poultry at the proper temperature to reduce bacterial spoilage and to reduce the number of human foodborne diseases by contaminated poultry.

Crystal Montoya
New Mexico Highlands University, Las Vegas, New Mexico
Mentor: Mary Shaw
Sponsored by: New Mexico Alliance For Minority Participation

Growth Patterns of Periwinkel and Snapdragons in Various Soils

Phytoplasmas are plant pathogenic prokaryotes that infect the phloem of many varieties of crops and ornamental plants causing the symptoms of stunting, shoot proliferation, greening of the flowers and severe yellowing of leaves. The phytoplasmas cannot be grown in culture so there is limited knowledge of their genetics. Periwinkle plants (*Catharanthus roseus*) were maintained in a growth chamber at NMHU. A consistent supply of healthy plants was needed to graft periwinkle inoculated with phytoplasmas. It seems the growing process of the healthy plants were slow after they were planted. This might be the cause of a certain type of soil.

Therefore, in the spring semester, 16 periwinkle plants were planed from seed into pots. The same amounts of Snapdragons (*Antirrhinum majus*) were also used to offer a variety of testing. All plants were watered on a daily basis with the same amount of water for each plant. They were also given the same amount of fertilizer every other week. Each plant was measured and leafs were counted for 10 weeks.

As a result, the soil type C (Shultz Professional Potting Soil Plus), gave the best grownt in the Periwinkle plants as well as the Snapdragon plants.

Kirby Notah
University of New Mexico—Gallup Branch, Gallup, New Mexico
Mentor: Kamala Sharma, Chemistry
Sponsored by: New Mexico Alliance For Minority Participation

Effect of Protein Sources on Rumen Forage Degradability Determined by in vitro Gas Production

An in vitro experiment was conducted to evaluate influences on microbial fermentation by measuring gas production in response to addition of protein supplement compared to protect and unprotected single amino acids. Our objective was to investigate responses of supplemental protein or amino acids on microbial fermentation of low quality forage. Four treatments with two types of McDougall's artificial saliva were used during this experiment. Extrusa samples were collected from two ruminally cannulated cows fed a basal diet of alfalfa. Gas displacement was measured every four hours for 96 hours.

Data were analyzed by analysis of variance using GLM procedure of SAS (SAS 2001). Total gas production were 543, 562, 503, and 599 mL for methionine (protected), no methionine, traditional, and methionine (unprotected) respectively. The rate of gas production were 0.02, 0.011, 0.01, and 0.11 ml/min for methionine (protected), no methionine, traditional, and methionine (unprotected) respectively. There were no observed differences between various types of artificial saliva used indicating that additional sulfur had no effect on microbial fermentation.

Diomaris Padilla, Vladamir Ortiz, Angel Guaraca, Tim Rice
City University of New York—The Graduate Center and City College, New York, New York
Mentor: Jeffrey Steiner, Earth and Environmental Sciences
Sponsored by: New York City Alliance for Minority Participation

Infrared-Sensing of Heavy-Metal-Bearing Dust Particles

Aerosols exist in our atmosphere as a gaseous suspension of fine solid, liquid, gel or composite particles. The origins of these particles vary from biological matter and pathogens to iron-rich soils and heavy metals, including mercury, arsenic and lead. While there is an abundance of man-made aerosols, there are still greater issues concerning those aerosols born of natural means. For example, in the African Sahara desert, dust storms occur naturally. These naturally occurring dust storms span the western coasts of Africa and travel through the Atlantic, journeying all the way to the Caribbean. The journeying dust particles remain in the Caribbean region till the North Eastern American summer period where the aerosols then continue to move in a northeasterly direction. As these dust particles travel they may deposit helpful nutrients essential to growth in areas like Hawaii, or harmful substances that thwart the growth of certain species like the soft coral in the Caribbean. Knowing the chemical composition of these aerosols makes it viable to predict and even counter such effects from airborne pathogens or poisonous heavy metals.

So far dust particles from Africa have been linked with a disruption in the marine environment of the Caribbean. Specifically seen in the coral reefs, the ill effects of these traveling aerosols have been underplayed for some time. There have even been some links to an increase of people with asthma in the Caribbean, a phenomenon also seen in the US. Dust storms from Africa can grow to the size of a small country, as seen in the photo below this recent African Dust storm was the size of Spain.

The purpose for this research will be to observe heavy-metal-bearing dust particles using infrared sensing in order to improve the characterization of known constituents, such as chlorides and sulfates, with an emphasis on the characterization of new organic and heavy-metal aerosols. Using Fourier Transform Infrared Spectrometry (FTIR) we will be analyzing the absorption intensities of the dust particles and using the absorption spectra generated to further identify the compounds found within the dust to see how they correlate with other chemical characterization procedures, such as x-ray fluorescence for heavy metals and GC mass spectrometry for organics.

Pamela Rodriguez, M.J. Feldhaus
Northern New Mexico Community College, New Mexico, Espanola, New Mexico
Mentor: Anthony Sena, Department of Math, Science and Engineering
Sponsored by: New Mexico Alliance For Minority Participation

Affinity Evolution of scFv Antibodies through Saccharomyces Cerevisiae Surface Display

Antibodies play a major role in cancer research. A library of scFv antibodies was created for display on the surface of yeast. Single chain antibodies are a small fragment of the entire antibdoy that contains the single antigen binding pocket. A clone was isolated that binds a peptide of the p53 protein. Joint technologies effectively screen diverse single chain (scFv) antibody libraries and identify scFv with specific binding affinities. A mutated library was created from this scFv clone through mutagenic PCR and an individual clone with higher affinity was isolated. Affinities (Kd) were determined and compared with the parental strain (Kd = 1 microM). Immuno-staining was coupled with flow cytometry to obtain their binding affinity, Kd values of individual clones, and was compared the parental yeast strain. When compared with the parental strain, there were several high affinity binding mutant yeast strains found. With the completion of the human genome project and the wealth of data being generated by proteome wide yeast two hybrid analysis, knock out mice, and other studies, the need for protein specific affinity reagents become increasingly sought after. {Feldhaus, M.J., Siegel, R., et. al., 2002} Affinity reagents that bind with high affinity and specificity are critical in proteomics research endeavors. These reagents are also becoming essential in interrogating the relationships in disease and cellular function.

Jonathan Trujillo
University of New Mexico—Valencia Campus, Los Lunas, New Mexico
Mentor: Celestyn Brozek, Department of Chemistry
Sponsored By: New Mexico Alliance for Minority Participation

Dissolved Oxygen: Molecular Oxygen (oxygen gas) Dissolved in Water

Accurate data on concentrations of dissolved oxygen (DO) in water are essential for documenting changes in the environment caused by natural phenomena and human activities. Sources of DO in water include atmospheric reaeration and photosynthetic activities of aquatic plants. Many chemical and biological reactions in ground water and surface water depend directly and indirectly on the amount of oxygen present. Dissolved oxygen is necessary in aquatic systems for the survival and growth of many aquatic organisms.

Two field methods for determining concentrations of DO in surface and ground waters are the amperometric method and the iodometric (Winkler) method. The amperometric method is the most commonly used field method for measuring DO in water. The amount of DO concentration is determined with a meter that works with a polarographic membrane-type sensor.

The Winkler method is the standard technique for the determination of dissolved oxygen in fresh and salt water. This scaled down procedure requires reduced sample volume and reduced reagent volumes. The concentration of DO is one of the most important indicators of the overall health of a body of water. Waters with consistently high levels of DO (> 6 mg/L) typically support the most diverse biological communities. Waters with consistently low DO levels (< 3 mg/L) may be virtually devoid of aquatic life or may harbor only a few species adapted to such conditions.

Ottono Usanga
City University of New York, New York, New York
Mentor: Loretta Taras, Department of Biology, Kingsborough Community College
Sponsored by: New York City Alliance for Minority Participation

Enhancement of Antifungal Antibiotic Production by Actinomycetes Isolated from Jamaica Bay

Actinomycetes are bacteria that produce a wide variety of antibiotic agents. Soil actinomycetes synthesize over 4000 of the naturally occurring antibiotics so far discovered. The study of bioactive marine actinomycetes is expected to yield unique bioactive compounds, including antibiotics, toxins, and pigments that are not found in terrestrial forms.

Marine sediment samples were collected from 7 sites in Jamaica Bay. Each sample was diluted, and plated in starch casein agar, chitin agar and actinomycete isolation medium. All plates were incubated for 4 weeks at 28OC. Actinomycete colonies were purified and tested for antibiotic production against 8 test organisms. Cultures that exhibited inhibition to fungal growth were further studied by altering media composition in order to enhance antibiotic production. The media (broths) included yeast extract, daunomycin (both served as controls), yeast extract +3% NaCl, daunomycin+ 3% NaCl, and half strength yeast extract.

Of 23 cultures, nine cultures showed no change in total size of zones of inhibition when 3% NaCl was added to yeast extract broth and daunomycin. Seven cultures showed an increase in antifungal production when 3% NaCl was added to yeast extract broth. Ten cultures showed increased inhibition to fungal growth after 3% NaCl was added to Daunomycin broth. Cultures grown in dilute yeast extract did not result in significant increase in size of zones of inhibition.

Nicole Wrice
Southwest Texas State University, Universal City, Texas
Mentor: Michael T. Blanda, Department of Chemistry and Biochemistry
Sponsored by: Texas A & M System Alliance for Minority Participation

Synthesis, Conformation and Binding Properties of Bis-Bridged Pyridinyl-Calix[6]arenes

Calixarenes have been studied and utilized for their molecular recognition properties. The focus of this research was to synthesize rigid calix[6]arenes and study their binding properties and structural conformations in solid, solution, and gas phase. Calix[6]arenes can exist in two flexible conformations: 1,4-cone and 1,2,3-alternate. To increase the rigidity of the cone conformation so it could conduct host-guest chemistry, p-tert-butylcalix[6]arenes were bridged with two bis(bromomethyl) pyridine molecules. The conformational arrangement of pyridinyl-calix[6]arenes was established and investigations of the relationships between their supramolecular isomeric structural differences and binding properties were made using C12 and H1 NMR titrations, liquid-liquid extraction, and x-ray crystallography.

Physical Science

Jedediah Alderete
New Mexico State University
Mentor: Charles Ying, Physics
Sponsored by: New Mexico Alliance for Minority Participation, US Army Research Office, NASA, and Los Alamos National Laboratories

Synthesis and Characterization of Semi-continuous Metallic Films

The study of semi-metallic thin films has been of great interest to optics research for some time. These films having unique optical and electrical properties are being studied to determine if there is a feasible way to implement them into current or future technology. Possible future applications have driven the research on these thin films. The semicontinuous silver films used in this study were synthesized by laser ablation with deposition of silver continuing up to the percolation threshold. The percolation threshold was determined from previous studies of the films surface morphology and the direct current (d.c.) electrical resistance as a function of metal concentration. Local optical properties of the percolation films are measured using near-field optical microscopy and have been compared with theoretical results. The goal of these experiments is to find agreement between theory and experiment and to explore the possibilities of these thin metallic films. Enhancement of the local electric field strength was evident near (above and below) the percolation threshold. Additional enhancement was seen at different incident laser light wavelengths. Results obtained by this research will be used in the continued study of optical properties of semicontinuous metallic films and their promise for use in future applications.

Desiree Connely
Southwestern Oklahoma State University, Weatherford, Oklahoma
Mentor: Brian D. Campbell, Chemistry
Sponsored by: Oklahoma Alliance for Minority Participation

Science, Mathematics, And Technology In Industry: Partnerships In Problem Solving

This program is designed to give 34 high ability high school juniors and seniors the opportunity to experience the close interrelationship between science and mathematics and its application to technology in industry and society. To accomplish this goal, a partnership has been formed between the academic science community of Southwestern Oklahoma State University and area high-technology industries such as Imation and Kodak Polychrome. During the first three weeks of the Academy, the participants will study four academic units relating science, mathematics, and computer science to technological applications. The SWOSU Departments of Chemistry, Physics, Mathematics, and Computer Science will offer these four units by professors at Southwestern Oklahoma State University. Each unit will include hands on laboratory and computer skills to enhance the students' problem solving ability. An interdisciplinary Academy Web site will be developed and all participants will be trained in e-mail and home page coding. During the 4th week of the Academy, the students, divided into small groups, will participate in a one-week interdisciplinary problem-solving unit dealing with specific industrial and technological problems directed by University scientists and industry staff. The students will participate in an oral and visual computer generated presentation of their findings. Objectives of the Academy will be designed to meet Priority Academic Student Skills (PASS) curriculum as well as National Standards in Science and Mathematics.

This proposal is also in alignment with the goals and objectives required by O-TEC (Oklahoma Teacher Education Consortium) as shown by the documents of support included. Additional enrichment activities include a physical fitness and recreational unit designed to entertain and enhance the participants overall self-esteem and interpersonal communication skills. Other activities include science related industrial field trips, weekly science and technology seminars, and a variety of social activities. Counseling designed to acquaint participants of the career opportunities in science and technology will be an integral part of the program. Data on the student's progress and continued study in science, mathematics, and technology education will be compiled. These data will address courses taken in the senior year of high school and college.

Erica M. Hart
Eastern New Mexico University, Portales, New Mexico
Mentor: Robert Pierce, Geology
Sponsored by: New Mexico Alliance for Minority Participation

Paleontology of the Upper Abo Section of the Oscura Mountains

The Abo Formation, located in the Oscura Mountains southeast of Socorro, New Mexico, is a thick reddish-colored clastic sediment unit. It is of Permian age (248-290 million years ago) and displays a cyclic sequence of sandstone, shale, conglomerates, and arkose. Traces of sedimentary features such as mud cracks, ripple marks, cross-beds, and raindrop impressions are present. The low-angle of the cross bedding indicates that the sand grains making up the rock were transported by water.

Amphibian tracks and plants fossils are common within the unit. Although often poorly preserved, Callipteris and Supaia were the most recognizable of the plant fossils found. The camera Lucida aided in magnifying the veination of the impressions making identification possible. Small circular features were also present in some specimens, suggesting fertile plant remains. The presence of ripple marks and preservation of fossil life is representative of a shallow and calm environment at the time of the deposition of the Upper Abo section.

Diana L. Kretzer
University of Texas at El Paso, El Paso, Texas
Mentor: Steven Aley, Microbiology
Sponsored by: University of Texas System Alliance for Minority Participation

Construction of Mini-Library for Shotgun Sequence of Plasmid DNA

Plasmids are small circular double stranded DNA molecules that have the ability to exist and replicate independently of the chromosome. The medical importance of plasmids is that they can carry genes for virulence factors, including genes for antibiotic resistance and survival in a host. In order to rapidly determine which genes are carried by specific plasmids we are developing protocols to use mini-library construction and shotgun sequencing of entire plasmids. Comparison of plasmid sequence with known DNA permit us to identify all relevant genes on a plasmid and understand the origin of those genes.

Michael R. Johnson
New Mexico Institute of Mining and Technology, Socorro, New Mexico
Mentor: Art Richmond and Astrid Maute, National Center for Atmospheric Research/United Corporation for Atmospheric Research; High Altitude Observatory/Terrestrial Impact of Solar Output/Foothills Lab, Boulder, Colorado
Sponsored by: New Mexico Alliance for Minority Participation

An Empirical Model of Ground-Based Magnetometer Data for the Study of Electric Currents in the Ionosphere over the North Polar Region

Variations in the Earth's magnetic field caused by electric currents in the ionosphere have been measured for over a century with the aid of magnetometers. Such variations change with magnetic latitude and local time as well as magnetic activity level due to the interaction of the Solar wind with the Earth's magnetosphere. Modern magnetometers employ sophisticated electronic circuitry to acquire measurements in units of nanoTesla. An empirical model of groundbased magnetometer data from high-latitude observation stations above N55 degrees magnetic latitude is compiled for analysis of variation, similarity, and trends with respect to location and magnetic activity level over time. Ionospheric magnetic activity over the polar cap and in the auroral zone is the object of study. An assessment of the geomagnetic disturbances is made to ensure accurate plotting and mapping of this activity and for model comparisons and predictions. Much is known about the structure and dynamics of ionospheric electric currents, yet it is hoped that this study will assist in uncovering more insight into the complexity of its changing patterns.

Leslie Lombard, Bobby Duplantier
University of New Orleans, New Orleans, Louisiana
Mentor: Ahok Puri, Department of Physics, University of New Orleans
Sponsored by: Louisiana Alliance for Minority Participation

Parametric Study of the CO2 Laser

The purpose of this project was to study how different parameters affect the output power of the PHYWE CO2 laser. We used variations of temperature, pressure and input voltage. Each parameter was varied over a certain range while the others were kept constant. Input current was kept at 40 mA for each experiment. The output power was recorded and graphed for each case.

This research project was conducted under the guidance of a research adviser. The results of the study were consistent with the optimal conditions of a properly functioning PHYWE CO2 laser. All the parameters were found to be close to the normal limits specified by the manufacturer. Our laboratory conditions, which were not ideal, may have been the cause of minor differences between the manufacturer's limits and our actual readings.

Damian Mattis
City University of New York—Medgar Evers College, Brooklyn, New York
Mentor: Wilbert Hope, Department of Physical Sciences
Sponsored by: New York City Alliance for Minority Participation

Assessment of Indoor Air Quality Using The Air Particle Analyzer Quartz Crystal Microbalance Cascade Impactor

Air particles play an important role in the determination of air quality, and are also major players in understanding the correlation between the environment and human wellness. Air quality has been at the forefront of scientific research since the realization of the presence of contaminants with detrimental effects on humans and their surrounding environment. Air particles are found in a range of sizes, some of which can be trapped by our natural defenses (i.e. nasal hair). However, other particles are much smaller and can easily travel into our lungs, thus making us more susceptible to its harmful effects.

In pursuit of a greater understanding of air particles, the Air Particle Analyzer QCM Cascade Impactor was used to carry out our project. This apparatus gives the count of particles at ten stages ranging from sizes as large as 25.0_m to as tiny as 0.05_m. All testing of the equipment was done at the campus of Medgar Evers College and readings were recorded and interpreted as preliminary findings in our quest to understand air particles and breathing environment.

Sybil Tobierre
City University of New York—City College, New York, New York
Mentor: Urs Jans, Department of Chemistry
Sponsored by: New York City Alliance for Minority Participation

Determination Of Polysulfides In Laboratory and Lake Samples Via Gas Chromatography

Aqueous polysulfides can be found in estuaries, salt marshes, lakes and contaminated groundwater. They slowly decompose into thiosulfate and bisulfide, and in the presence of oxygen partial oxidation of bisulfide can form polysulfide ions introducing an error in the analysis of polysulfide ions originally present. However at room temperature and under anoxic conditions, aqueous polysulfides are stable and their direct determination poses fewer challenges. In this work samples are analyzed using gas chromatography (GC) with a flame-ionization detector (FID). Polysulfides are first converted to elemental sulfur in a phthalate buffer under anoxic conditions then extracted with toluene containing excess triphenylphosphine with anthracene as internal standard. The triphenylphosphine sulfide formed is then analyzed using GC-FID and is directly related to the total amount of dissolved sulfur zero and in turn the polysulfides in the original sample. Use of this method resulted in a recovery of polysulfides ranging from 88% to 98% for laboratory samples. The method was then applied to samples obtained from the Lower Mystic Lake, Arlington, MA for which concentrations of polysulfides obtained ranged from 58 uM to 88 uM.

Rippy Williams
University of New Mexico—Gallup Branch, Gallup, New Mexico
Mentor: Kamala Sharma, Department of Math and Science, UNM-Gallup
Sponsored by: New Mexico Alliance for Minority Participation

Detection of Potassium Channels in Sternopygus acrurus using Immunohistochemistry

Potassium ions contribute to the maintainance of the normal ionic balance across cell membranes. Potassium helps a lot in excitable cells like those in muscles and nerves, by re-establishing the electrical difference inside and outside of the cell after electrical excitation. In the weakly electric fish (Sternopygus macrurus), which can regenerate its own tail, we are looking to see which potassium channels are present in the contro adult tail. Specifically, we are interested in the immunohistochemical characterization of potassium channel isoforms in the spinal cord, electrolytes, and skeletal muscles of the tail in S. macrurus. Our preliminary results are incomplete at this time, and thus further studies are necessary.

Projects/Display Abstracts

This is a non-competitive category for posters showing informative projects, such as New Mexico AMP student clubs, or classroom-based capstone course projects, term paper projects, science/math related projects/activities. This category is open to all students—high school, community college, and university level.

Ramon Almonte
City University of New York—Queens College, Flushing, New York
Mentor: Kennth Lord, Department of Computer Science
Sponsored by: New York City Alliance for Minority Participation

Using JDBC, Servlets and JavaScript for the National Honors Society for the Computer Science UPE Web Form

UPE (Upsilon Pi Epsilon) is a national honor society for the computing sciences, established for the promotion of high scholarship and original investigation in Computer Science. An HTML web page was used as an application to get general information about students interested in being part of the society. One of the purposes of this project is to automate the process of the application and the interaction of the applicant with the application as much as possible. This will save time and money, and the processing will be done without any the interference of a human.

At first, the application consisted of a single HTML web page. The first step of the project was to divide this web page into three separated, but linked, web pages. Each page will have a different but related purpose.

The first page done was the Help page. In this page the user will be able to find information about the processing of the application and requirements. It will also provide answers to the most frequently asked questions regarding UPE and the application itself.

The second page is a small application written in JavaScript. JavaScript is Netscape's cross-platform, object-based scripting language for client and server applications. JavaScript lets you create applications that run over the Internet. Client applications run in a browser, such as Netscape Navigator, and server applications run on a server, such as Netscape Enterprise Server. Using JavaScript, you can create dynamic HTML pages that process user input and maintain persistent data using special objects, files, and relational databases (developer.netscape.com). The script or program is interpreted and run by the web browser while loading the html page containing the script. The browser must support JavaScript in order for the script to work and run. The script can be place anywhere inside the HTML page. It can also be placed outside of the HTML page as a separate file and then called from the HTML page requiring the script. The advantage of this is that the script can be used as many times as wanted by different web pages.

The third page consists of the Application itself. In this page, information about the applicant is asked and validated before being sent. The validation consists of making sure that the user enters the correct data in the fields. The first fields or part of the application requests information about the student, such as the name and email address. The next part asks for total amount of credits obtained. In the total field, with the use of the JavaScript language, the total amount of credits is calculated automatically. The last part of the application has a list of Departments from Queens College from which the user can choose. By selecting a Department, a script shows a custom list of classes offered by the Department that are required by the curriculum of the Computer Science Department. The user then chooses the grade, along with the GPA, obtained in the class. The user then clicks the Add button. And this will create a list of all the grades and classes taken by the student.

Danielle Garcia
New Mexico State University
Mentor: Phil King, Civil and Geological Engineering
Sponsored by: New Mexico Alliance for Minority Participation

Water Quality and Measurement

During the summer, I worked with Dr. King with the civil engineering department at NMSU and some other people at the irrigation district in Las Cruces. I got highly acquainted with the tools and processes used at the irrigation district. I learned the different methods of measuring the water depth, the average velocity, and at what height to set the gates at the bridges. I learned about the different component of water. The major ions commonly found in the water and how to test the water's conductivity and salinity.

I also worked on another project that Dr. King was just beginning. He was taking some data that dated back to the fifties of different measurements of the major dams and waterways in the irrigation district. He was going to try and predict a pattern for the years to come on what the water quality is going to be like when the water in the dam is extremely low. Unfortunately I was unable to stay long enough to see the results, but we did obtain some graphs and started on some hypotheses.

Mark Montoya
Luna Community College, Las Vegas, New Mexico
Mentor: Anthony Hyde, Electronics Technology
Sponsored by: New Mexico AMP

Luna Community College 1st Annual Summer Bridge with NMSU

Luna Community College offered the 1st ever Summer Bridge Program with NMSU Engineering Technology Department. Students enrolled at NMSU for 3credit hours while working on a mentored project for 20hrs. per week. On this particular project the student learned to develop skills on the lathe and mill machines in the NMSU ET Machine Shop.

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