

## 2006-2007 ONR Research Teams

### Estimating Firn Emissivity on the West Antarctic Ice Sheet

**Mentor: Dr. Malcolm LeCompte**

Brian Campbell Jerome Mitchell Jamika Baltrop  
TreAsia Fields Fayana Graham

### Case Study: Undergraduate Research Office Network Redesign

**Mentor: Mr. Chris Edwards**

Bryce Carmichael Ebony Addison Lovell Pendleton  
Cheniece Arthur

### GIS Water Quality

**Mentor: Mrs. Keisha Wilkins, Mr. Joseph Ausby**

Lee Smalls, Jr. Kaiem Frink Akeem Archer

### Correlations between the Concentrations of Chlorophyll a in Surface Waters and Dissolved Oxygen in Bottom Waters of the Northern Gulf of Mexico

**Mentors: Dr. Jinchun Yuan / Ms. Karitsa Williams**

Gregory Brown Unquiea Wade Travis Capehart

### Developing Standards and Practices for Digitizing and Archiving Multimedia Material from the URE and Other Associated Programs

**Mentor: Mr. Jeff Wood**

Tiwana Walton Illiana Thomas Jasmin Rivers

## Dates to Remember

<http://nia.ecsu.edu/events.html>

**January 11, 2007, 5:00 pm**  
**Preparing for Graduate School**  
Room 229 Dixon Hall, ECSU

**January 11-14, 2007**  
**2007 FOCUS**

Georgia Tech, Atlanta, Georgia

**February 8-10, 2007**  
**2007 ADMI Symposium**  
Atlanta, Georgia

**February 12-16, 2007**  
**ECSU Research Week**

**March 20, 2007**

**IEEE-GRSS Distinguished Lecture Series**

229 Dixon Hall Elizabeth City State University

**Dr. Robert Bindshadler, NASA GSFC**

Understanding the West Antarctic Ice Sheet from Space:  
Beyond Dogsleds and Frozen Toes

Meeting of the Eastern North Carolina Chapter of the IEEE  
Geoscience and Remote Sensing Society (GRSS)

**April 12, 2007, 2:00 pm**  
**Watershed Watch Summer Program Briefing**  
Room 229 Dixon Hall, ECSU

**May 29 - June 9, 2007**  
**Watershed Watch Summer Program**  
Application

[http://nia.ecsu.edu/ww/ww\\_0607\\_application.pdf](http://nia.ecsu.edu/ww/ww_0607_application.pdf)

**May 31 - July 18, 2007**  
**Undergraduate Research Experience in Ocean and Marine Science**  
Application  
[http://nia.ecsu.edu/ureoms2007/2007\\_ureoms\\_application.pdf](http://nia.ecsu.edu/ureoms2007/2007_ureoms_application.pdf)

**July 23-27, 2007**  
**IEEE - International Geoscience and Remote Sensing Symposium**  
Barcelona, Spain



# NERT

## NURTURING ECSU RESEARCH TALENT

## 2005-2006 Program Highlights / Summer 2006 Research Abstracts

**Jerome Mitchell** - Senior, Computer Science

**Mentor:** Dr. Mark Fahnestock

**Internship:** University of New Hampshire

**Title: Using Active and Passive Microwave Records For Detecting Firn Characteristics In Greenland: A New Indication Of Melt**

Satellite-based active microwave imaging instruments (Synthetic Aperture Radars and Scatterometers) and passive microwave radiometers are recording the modification of the structure of the firn, the compacted snow layer that has remained at or near the surface of an ice sheet for one season but has not yet compressed into glacial ice, on the Greenland ice sheet caused by new melting at high elevation. Even a few days of melt at a site on the ice sheet that has not melted in decades can produce a large sustained change in the microwave scattering properties of the snowpack; this change is clearly reflected for years, diminishing only slowly as the layer generated by the melt event is buried. In the last 5 years, x% of the area of the dry snow zone has been modified in this manner by surface melt, compared with y% (little modification) in the previous 9 (to 13 or 20+ years, depending on the data used); these effects decay slowly, and if the present trend toward increased melting continues, the dry snow zone (melt-free snowpack) of the interior of Greenland could disappear completely in the near future. A melt detection technique calculated data for the passive microwave record, and it produced an approximate amount of melt days compared to the active microwave records done by previous investigators; this allowed for a new indication of melt as well as greater time series in the passive microwave record.



**Cheniece Arthur** - Junior, Computer Science

**Bryce Carmichael** - Sophomore, Computer Science

**Mentor:** Dr. Arvin Agah

**Internship:** Center for Remote Sensing of Ice Sheets (CReSIS), University of Kansas  
**Title: Simulating Deployment & Retrieval of Seismic Sensors**

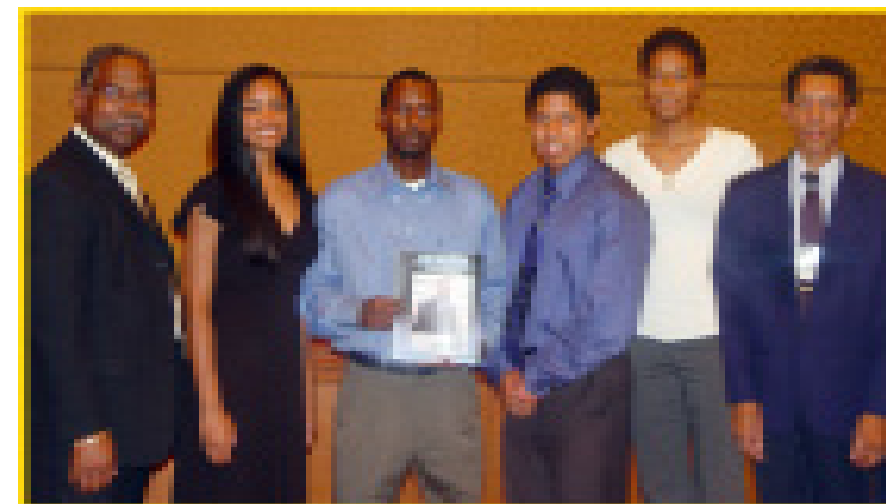
The primary objective of our project was to successfully create a robotic simulation that illustrated how numerous robots will assemble in order to collect seismic data. In contrast to the human approach of physically deploying and receiving seismic data, robots would instead be used to collect data. Once a designated location has been determined, the robot would plant the geosensor and collect the vibration data after the seismic source has taken place. With the use of robots, human life is not at risk. Due to the harsh and dangerous weather conditions in the Antarctic and Greenland environment, robots would replace manual labor. With an abundance of robots, we would be able to collect a large amount of data over a short period of time.



We utilized a 3-D graphical interface program called "Webots" to simulate how a team of mobile robots would assemble into grid formation and migrate from one location to another. Webots is a mobile robotic simulation software package that allows one to model robots and test in a world created by the user. This program uses physics as well as code to validate and test different methods when an action is declared. As we continued to gain knowledge of Webots, we created and tested different formations using the robots in the program. The formations completed their work in different shapes and patterns in order to follow the desired paths.

### 2006 National Technical Association Symposium Student Winners

(l to r) Dr. William Lupton, past president of the NTA, Tashara Banks, Kenneth Kimari, ONR research students Bryce Carmichael and Cheniece Arthur, and Dr. George Carruthers during the 2006 NTA Symposium in Chicago, Illinois.



## Office of Naval Research

One Liberty Center

875 North Randolph Street, Suite

1425

Arlington, VA 22203-1995

For more information visit our web site: <http://nia.ecsu.edu/ur/>

Elizabeth City State University

Box 672 1704 Weeksville Road Elizabeth City, NC 27909 (252) 335-3696/voice (252) 335-3790/fax  
Grant Numbers: ONR - URE in O/M Science N00014-01-1-0529 AVHRR SST N00014-01-1-1070



**Karitsa Williams** - Graduate, Computer Science  
**Mentor:** Mrs. Keisha Wilkins, ECSU - CERSER  
**Internship:** Undergraduate Research Experience in Ocean and Marine Science, ECSU  
**Title: Automating the TeraScan Image Process for Creation of NOAA AVHRR Data Products**

During the summer of 2002 the Center of Excellence in Remote Sensing Education and Research (CERSER) was established on the campus of Elizabeth City State University. It is the intent of CERSER to develop innovative and relevant research collaboration focused on coastal, ocean, and marine research. The project represents a joint effort by the Office of Naval Research (ONR), the MU-SPIN Office of Goddard Space Flight Center (GSFC), the National Oceanic and Atmospheric Administration (NOAA) and SeaSpace.



In addition to providing remotely sensed Advanced Very High Resolution Radiometer (AVHRR) and Sea Wide Field-of-View Sensor (SeaWiFS) data for research projects during the summer and academic year, CERSER maintains a website which displays and archives data that has been captured and processed. Since the establishment of the CERSER lab, data has been processed, annotated and converted into tiff files manually by using a series of TeraScan and LINUX commands. This process is time consuming and requires a person to physically be at the TeraScan Machine.

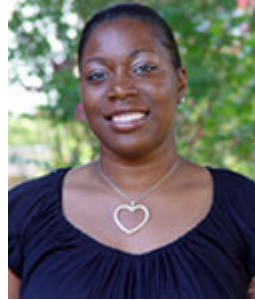
The objective of this project was to automate the process of creating NOAA AVHRR products. The TeraScan Product Generation System was utilized to create a visible and sea surface temperature image. This was accomplished by first creating a master of North Carolina and Virginia. A master is a TeraScan dataset that delimits a geographical area of the earth and specifies a map projection and a pixel resolution to the area. The master was used for the sea surface temperature product. Visible images were processed from the complete raw AVHRR data.

A script was created which processes raw AVHRR data from the passdisk. A script is a sequence of commands linked together to automatically run when initiated. A script can be initiated by running it from the command line or by linking the processing to TeraCapCon (TeraScan Capture Control).

Once passes are captured on the passdisk the script processes the image and generates a picture product. Each image, overlaid with a coastal boundary, gridlines, a wedge and a legend, is converted into a tagged image file format (tiff) file and automatically distributed to the server using file transfer protocol (ftp). Automating the image process eliminates the need for an individual to manually process images, and insures that the CERSER webpage is current.

**TreAsia Fields** - Sophomore, Math  
**Mentors:** Dr. Raj Chaudhury & Dr. Lin Chambers  
**Internship:** NASA SPHERE 2006 - Christopher Newport University (CNU)  
**Title: Data/Visualization Team**

This summer the Data/Visualization Team was responsible for creating a google map of local and remote GLOBE sites and their data on environmental phenomena that are linked using Google Maps and GPS (Global Positioning Service). Also the team created a walking tour of CNU and the Shenandoah Valley. The LAS stores satellite data on cloud coverage, surface Temperature, tropospheric ozone and other parameters, which is monitored by ground stations. This information will be linked to the google map to display the climate factors of each specific area. This information is useful for everyone, it makes it easy to identify geographical locations and their associated data from both satellite and ground stations.



**Unquiea Wade** - Sophomore, Computer Science  
**Mentor:** Dr. Prasad Gogengni  
**Internship:** Center for Remote Sensing of Ice Sheets (CReSIS), University of Kansas  
**Title: Airborne Measurement of Snow Thickness Over Sea Ice**

Snow cover on sea ice plays an important role in the climate of the polar regions. Snow on the sea ice reduces the heat exchange between the ocean and the atmosphere by its high albedo (reflectivity) and low thermal conductivity. The lower the albedo, the less solar energy is reflected back into the atmosphere. This energy is absorbed into the ocean. The warmer water will melt more sea ice, and eventually the warmer atmosphere above the warmer water will melt more of the sea ice in the polar regions. Better data on the extent and thickness of snow cover are therefore needed to understand the condition and future behavior of sea ice.



Up until recently, the only practical means of observing snow cover over sea ice was by satellite remote sensing. The Advanced Microwave Scanning Radiometer (AMSRE) onboard NASA's Aqua satellite does precisely this. To validate the measurements made by AMSR-E, the University of Kansas developed an ultra-wideband frequency-modulated continuous-wave (FM-CW) airborne radar to measure snow thickness over sea ice. This system was flown over the Arctic sea ice in March 2006 to measure the snow thickness.

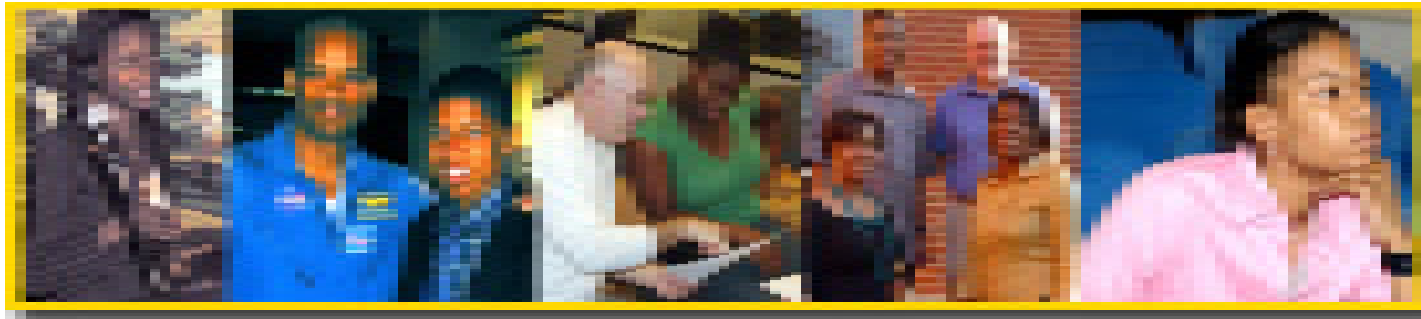
## Photo Highlights

The Office of Naval Research Nurturing ECSU Research Talent program involves undergraduate mathematics and computer science majors in academic year team research activities. Research and training meetings began in early September and are held every Tuesday and Thursday 5-8 PM through mid April. Research meetings start with a 20-30 minute announcement period during which time students learn about internship opportunities, hear program announcements, give team reports, discuss travel logistics, and discuss goals of the program. Following the announcement period, students meet with faculty mentors or attend training on tools used for research. In addition, students spend 20 hrs/week in the undergraduate research computer laboratory completing task sheet requirements and research assignments. The closing program is held on two nights in April. During the closing program, students make oral presentations of their research activities. The research teams are also required to complete written reports and to maintain a team web page. Shown below are highlights from the academic year program.





ONR student researchers Jerome Mitchell (L) and Kaiem Frink (R) deliver poster presentations during the ADMI 2005 Symposium entitled "Modeling Diversity in Computing and Engineering" in Rincon, Puerto Rico.



ONR student researcher Jerome Mitchell (L) and Dr. Prasad Gogenini, Director of the Center for Remote Sensing of Ice Sheets (CReSIS) at the West Antarctic Ice Sheet (WAIS) field camp.

Jerome Mitchell was the only undergraduate researcher taking part in this research trip to Antarctica sponsored by the National Science Foundation to test theories on Global Warming.



**Kaiem Frink** - Junior, Computer Science  
**Lee Smalls, Jr.** - Sophomore, Computer Science  
**Mentor:** Dr. Malcolm LeCompte, ECSU - CERSER  
**Internship:** Undergraduate Research Experience in Ocean and Marine Science, ECSU  
**Title: Estimating Antarctic Firn Average Emissivity Trends at the Ski Hi Automatic Weather Station 1994-1998**

Firn is compacted, near-surface snow enduring for more than one season not yet compressed into glacial ice. Knowledge of firn surface temperature trends across the Antarctic ice sheet is useful for documenting and quantifying change and providing a temporal and spatial context for research during the Antarctic International Polar Year (IPY). Satellite passive microwave radiometer data can provide surface temperature trend estimates across limited temporal and spatial gaps in Automatic Weather Station (AWS) coverage. Techniques to derive surface temperatures from passive microwave data have been pioneered by Jezek et al., (1993) and Shuman et al., (1995).



Using the methods of previous researchers, the Summer 2006 Undergraduate Research Experience (URE) Antarctic Temperature Mapping Team, is comparing archived surface temperature data from an AWS on the West Antarctic Ice Sheet with coincident daily brightness temperature data collected by the Special Sensor Microwave Imager (SSM/I) aboard the Defense Meteorology Satellite Program (DMSP) polar orbiting meteorology satellite series. The ratio of passive microwave brightness temperature and AWS in-situ near surface temperature provides the firn emissivity estimate necessary to extrapolate surface temperature trends across temporal and spatial gaps in either the AWS or SSM/I record. The relationship between emissivity and surface temperature is generally known as the 'Rayleigh-Jeans Approximation' (Hall and Martinec, 1985). The spatial and temporal variability of firn emissivity is not well understood but known to be much less variable than daily temperature.

AWS temperatures at 3 hourly intervals for the "Ski Hi" AWS site (75° South Latitude, 71 ° West Longitude) in West Antarctica were obtained from the AWS Project data archive at the University of Wisconsin's Space Science and Engineering Center (SSEC). The passive microwave time-series of daily DMSP SSM/I brightness temperatures, geographically and temporally coincident with the Ski Hi site were obtained from Dr. Chris Shuman at NASA Goddard. Daily SSM/I brightness temperatures and corresponding Ski Hi AWS surface temperatures were tabulated in a Microsoft EXCEL spread sheet. The daily ratio of the SSM/I brightness temperature to the AWS surface temperature

provided an emissivity trend from which to extrapolate surface temperatures. The Ski Hi AWS operated from late February 1994 until late November 1998. The team will develop mathematical/statistical techniques to robustly estimate the surface emissivity trend at the Ski Hi site for the period January 1, 1995 through November, 1998, and use it to obtain a continuous estimate of surface temperature during data gaps in either the SSM/I or the AWS archive. Future work will establish emissivity trends at other AWS sites. These values will be combined with surface elevation data to extrapolate emissivity values beyond the locale of the AWS stations. Average surface temperatures can then be calculated from SSM/I brightness temperature records as well as data from other satellite sensors observing the Antarctic continent during the last 30 years. This work is thus a preliminary step to deriving a surface temperature trend across the entire Antarctic ice sheet from 1981 through to the present.

**Anthony Anderson** - Senior, Computer Scientist  
**Timothy Harrell** - Senior, Computer Scientist  
**Mentor:** Dr. David Stevenson, Dr. Kevin Chu  
**Internship:** NOAA's Northeast Regional Office  
**Title: Massachusetts Young-of-the-Year Bottom Trawl Survey**

Designating essential fish habits are important because they protect specific species of fish from becoming extinct. To help aid the process we took a look at young of the year species in the north east region of the United States.

We are interested in knowing anything that will affect the numbers of young-of-the-year (YOY) juveniles caught in each survey and the environmental variables that could be correlated with geospatial data on catch rates (number of fish per tow).



Mr. Antonio Rook, past ONR researcher and current faculty at ECSU talks with Demetrius Rorie





The 2006 International Geoscience and Remote Sensing Symposium, "Remote Sensing - A Natural Global Partnership", took place in Denver, Colorado. The focus of the symposium was the widespread distribution and interoperability of remote sensing and environmental data and information as many countries begin launching remote sensing satellites.

Elizabeth City State University was represented by Dr. Linda B. Hayden, Director of the Center of Excellence in Remote Sensing Education and Research (CERSER). Dr. Hayden joined with Dr. Ali Omar of the NASA Langley Research Center in Hampton, Virginia in presenting "Collaborations Focused on Enhancing Undergraduate Involvement in Remote Sensing Applications to Atmospheric and Earth Science Research" a comprehensive look at the mentoring strategies used with groups of undergraduate physics, mathematics and atmospheric science majors to develop their ability to contribute to remote sensing investigations. The projects discussed were joint efforts of scientist and educators at NASA Langley Research Center, Hampton University in Virginia, ECSU, Stennis Space Center, and The Office of Naval Research. Also attending were Malcolm Mathis II (UAPB) and Brittany Green (SCSU).

Malcolm presented on the topic "Exploring the Migration of the Roanoke Colonists", research looking at tracking the "lost colony" on Roanoke Island using data from satellite based Optical and ISAR instruments and aerial LIDAR which were compared to observe and quantify the terrain and environment of the historical locales. Ground Penetrating Radar, and geologic core samples at the sites were also used during this research.

Brittany's research presentation was titled "Spatial-Explicit Growth Rate Model of Young Striped Bass in Albemarle Sound: Implications on Essential Fish Habitat (EFH) Using GIS." This research examined the growth rate potential of juvenile striped bass *Morone saxatilis* in Albemarle Sound, North Carolina, to identify essential fish habitat (EFH) for striped bass during the summer and early-fall months.



**Research**  
Linda B. Hayden  
Director of CERSER

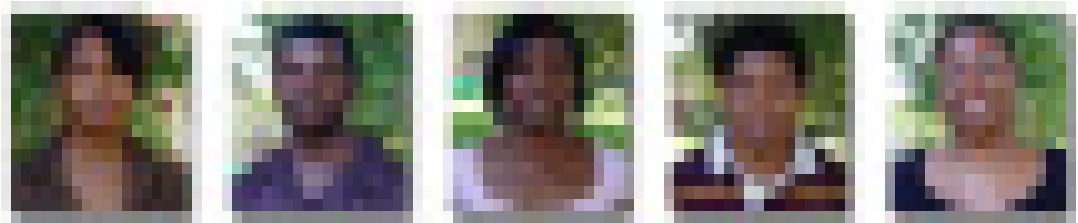


**Research**  
Brittany Green  
Undergraduate Researcher

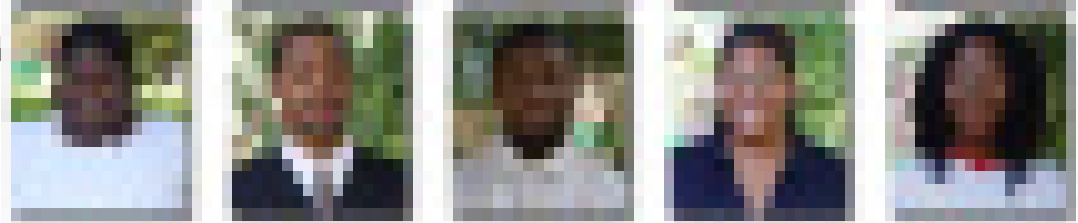


**Research**  
Malcolm Mathis II  
Undergraduate Researcher

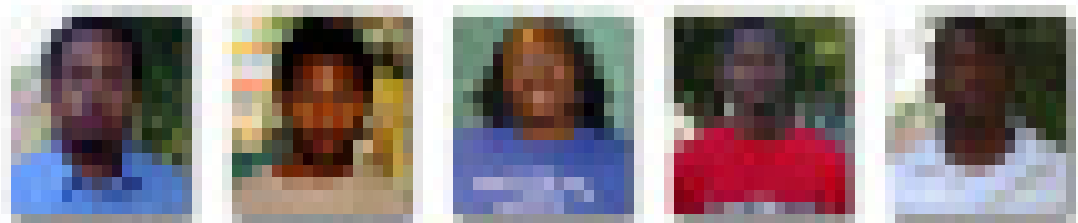
**Research**  
Dr. Ali Omar  
NASA Langley Research Center



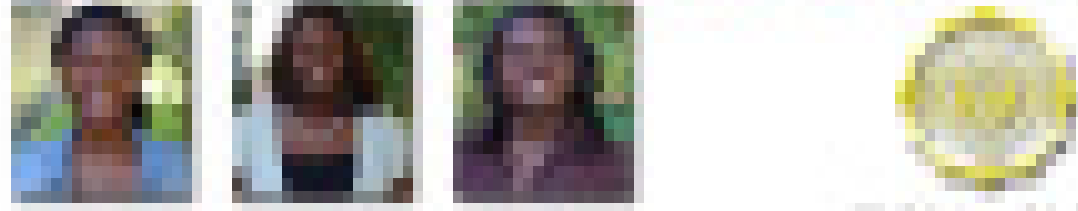
**Research**  
Dr. Ali Omar  
NASA Langley Research Center



**Research**  
Brittany Green  
Undergraduate Researcher



**Research**  
Brittany Green  
Undergraduate Researcher



## HONORS CONVOCATION AWARDS

Center of Excellence in Remote Sensing Education and Research (CERSER)



### CERSER "Research Program" Award

Criteria: Second Semester freshman or above, 3.0 current or cumulative GPA, attending research training seminars  
Award: Certificate/\$150.00  
Recipients: Lovell Pendleton :: Jasmine Rivers :: Illiana Thomas :: Tiwana Walton :: Jermaine Moore :: Kaiem Frink

### CERSER "Research Scholars" Award

Criteria: Sophomore or above, 3.0 current and cumulative GPA, attending research training seminars, completed at least one approved internship  
Award: Certificate/\$250.00  
Recipients: Bryce Carmichael :: TreAsia Fields :: Lee Smalls, Jr. :: Cheniece Arthur :: Brian Campbell :: Unquiea Wade

### CERSER "Award of Excellence"

Criteria: Graduating Senior, 3.0 Current or cumulative GPA, attending research training seminars, admission into graduate school with financial support, completed at least two approved internships  
Award: Certificate/\$1500.00  
Recipient: Jerome Mitchell