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14. ABSTRACT

15. SUBJECT TERMS

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a. REPORT UU	b. ABSTRACT UU	c. THIS PAGE UU			19b. TELEPHONE NUMBER 803-535-5698

RPPR Final Report
as of 27-Sep-2021

Agency Code: 21XD

Proposal Number: 74358CHREP

Agreement Number: W911NF-19-1-0505

INVESTIGATOR(S):

Name: Derrick Swinton
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Principal: Y

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DUNS Number: 014778158

EIN: 570314374

Report Date: 14-Dec-2020

Date Received: 14-Dec-2020

Final Report for Period Beginning 15-Sep-2019 and Ending 14-Sep-2020

Title: Acquisition of a High-Resolution Mass Spectrometer to Enhance the Interdisciplinary Research and Education at Clafin University

Begin Performance Period: 15-Sep-2019

End Performance Period: 14-Sep-2020

Report Term: 0-Other

Submitted By: Derrick Swinton

Email: deswinton@claflin.edu

Phone: (803) 535-5698

Distribution Statement: 1-Approved for public release; distribution is unlimited.

STEM Degrees: 3

STEM Participants: 7

Major Goals: The instrument will be used to achieve the following objectives: 1) enhance the research and training infrastructure for faculty and students: 2) broaden the participation of women and minorities in STEM disciplines: 3) enable the development of new interdisciplinary and cross-disciplinary courses: 4) improve the quality of graduating STEM students by enabling students to train on advanced instruments used in industry, thus preparing them for success in the workforce. Acquisition of the mass spectrometer will enable faculty, undergraduate, and graduate students the opportunity to engage in high-quality materials science-related research and education, attract students to STEM programs at Clafin University, and enable the university to provide a rigorous curriculum. The Mass Spectrometer will be integrated into the lectures and general laboratory curriculum of relevant courses, particularly Analytical Chemistry, Instrumental Analysis, and Biochemistry, where mass spectrometry is currently taught from a fundamental and limited perspective. Acquisition of the instrument will enable faculty to delve deeper into advanced concepts and applications of the instrument.

Accomplishments: 1. One Publication

2. One Conference Proceeding

3. Two hundred and fourteen students were trained on the instrument, not including members of the PIs research group (5).

4. Three faculty were trained on the instrument and as result have developed research projects that integrate mass spectrometry as an investigative tool.

5. Four faculty are using the instrument to support their research projects.

5. Clafin University has secured funding for the next several years to buy a service contract from Waters corporation to keep the instrument operational for many years.

6. A full-time lab manager, Mr. Brandon Yarbrough, was hire to serve as Lab manager and Instrument Specialist. Mr. Yarbrough devotes 50% of his time to the maintenance and operation of the equipment.

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Training Opportunities: Integration into Courses:

The mass spectrometer was used consistently in four undergraduate courses, Quantitative Analysis, Organic Chemistry, Biochemistry, and Instrumental Analysis. These courses teach students fundamental and theoretical concepts related to wet chemistry and instruments. The courses are coupled with laboratory experiments, where students get hands-on training. As proposed, several lab experiments were developed that incorporate the mass spectrometer for analyzing samples in complex matrices.

During the reporting period, a total of 214 students used the instrument for the purpose of completing their respective lab assignments.

During the reporting period, three faculty were trained in operating the instrument.

Results Dissemination: Claflin University's Marketing and Communication Department promoted the acquisition of the instrument to the public via publications in local and regional news outlets. The intent was to inform the public of the instrument acquisition, encourage research collaborations with the local communities, industry, and higher education institutions. The intent was also to update the public on the support DOD provides to HBCU to enhance their research infrastructure.

Links to published news articles are provided below.

<https://online.publicationprinters.com/html5/reader/production/default.aspx?pubname=&edid=6a4e79f6-fbe7-45a8-8170-19176aa1a7d6>

https://www.carolinapanorama.com/eedition/page-----cp-page/page_ca64243f-382a-5eef-8cda-7db1482ef2a0.html

Honors and Awards: Nothing to Report

Protocol Activity Status:

Technology Transfer: Nothing to Report

PARTICIPANTS:

Participant Type: Technician
Participant: Brandon Yarbrough
Person Months Worked: 6.00
Project Contribution:
National Academy Member: N

Funding Support:

Participant Type: Faculty
Participant: Mihir Mandal
Person Months Worked: 3.00
Project Contribution:
National Academy Member: N

Funding Support:

Participant Type: Faculty
Participant: Arzue Boroujerdi
Person Months Worked: 2.00
Project Contribution:
National Academy Member: N

Funding Support:

Participant Type: Technician

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Participant: Stephon Void

Person Months Worked: 3.00

Project Contribution:

National Academy Member: N

Funding Support:

Participant Type: Graduate Student (research assistant)

Participant: Kimberly King

Person Months Worked: 3.00

Project Contribution:

National Academy Member: N

Funding Support:

Participant Type: Graduate Student (research assistant)

Participant: Omotola Shode

Person Months Worked: 3.00

Project Contribution:

National Academy Member: N

Funding Support:

Participant Type: Faculty

Participant: Uruthira Kalapathy

Person Months Worked: 3.00

Project Contribution:

National Academy Member: N

Funding Support:

Participant Type: Research Experience for Undergraduates (REU) Participant

Participant: Merylin Palmer

Person Months Worked: 3.00

Project Contribution:

National Academy Member: N

Funding Support:

Participant Type: Research Experience for Undergraduates (REU) Participant

Participant: Tekiah McClary

Person Months Worked: 3.00

Project Contribution:

National Academy Member: N

Funding Support:

Participant Type: Undergraduate Student

Participant: Diamond Graves

Person Months Worked: 6.00

Project Contribution:

National Academy Member: N

Funding Support:

Participant Type: Undergraduate Student

Participant: Monet Mitchell

Person Months Worked: 3.00

Funding Support:

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Project Contribution:
National Academy Member: N

Participant Type: Graduate Student (research assistant)

Participant: Gift Nwokeji

Person Months Worked: 3.00

Funding Support:

Project Contribution:

National Academy Member: N

Participant Type: Faculty

Participant: Omar Bagasra

Person Months Worked: 3.00

Funding Support:

Project Contribution:

National Academy Member: N

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Date Submitted: 12/12/20 12:00AM

Date Published: 3/1/20 5:00AM

Publication Location:

Article Title: Comparative Analysis of Au and Au@SiO₂ Nanoparticle-Protein Interactions for Evaluation as Platforms in Theranostic Applications

Authors: Derrick J. Swinton, Hongxia Zhang, Arezue F. B. Boroujerdi, Keyana L. Tyree, Ricardo A. Burke, Makay

Keywords: Metal nanoparticles, Peptides and proteins, Nanoparticles, Dynamic light scattering, Aggregation

Abstract: Gold nanoparticles are utilized in a variety of sensing and detection technologies because of their unique physiochemical properties. Their tunable size, shape, and surface charge enable them to be used in an array of platforms. The purpose of this study is to conduct a thorough spectroscopic characterization of Au and functionalized hybrid Au@SiO₂ nanoparticles under physiological conditions and in the presence of two proteins known to be abundant in serum, bovine serum albumin and human ubiquitin. The information obtained from this study will enable us to develop design principles to synthesize an array of surface-enhanced Raman spectroscopy-based nanoparticles as platforms for theranostic applications. We are particularly interested in tailoring the surface chemistry of the Au@SiO₂ nanoparticles for applications in theranostic technologies. We employ common spectroscopic techniques, with particular emphasis on circular dichroism and heteronuclear single quantum correlation nuclear

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Acknowledged Federal Support: Y

CONFERENCE PAPERS:

RPPR Final Report
as of 27-Sep-2021

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Publication Status: 1-Published

Conference Name: National EPSCoR Conference

Date Received: 12-Dec-2020 Conference Date: 27-Oct-2019

Date Published: 27-Oct-2019

Conference Location: Columbia, SC

Paper Title: Porcine internal thoracic artery decellularization: Effects of chemical and physical parameters

Authors: J. Hohn, C. Fix, CJ Kostelnik, MM, Stern, D. Swinton, WJ. Richardson, JF. Eberth, W. Carver

Acknowledged Federal Support: **Y**

Partners

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I certify that the information in the report is complete and accurate:

Signature:

Signature Date:

The new software development program is staffed by existing faculty but will expand to include adjunct professors and industry partners in the tech industry. Students take required classes in full-stack web development, mobile web development, computer ethics, and human values, as well as human-computer interaction.

Its first graduates could earn their degrees as soon as May 2021. Currently, there are freshmen, sophomores, and juniors enrolled. Based

Only **7%** of employed black professionals with a bachelor's degree or higher work in science, technology, engineering, and mathematics (STEM) fields, a study by Pew Research shows. The average salary for a software engineer is about **\$107,300**, according to Glassdoor.com.

on an informal audit of computer science programs at HBCUs across the country, Gosha said it appears that Morehouse is the first to offer a degree in software engineering.

Recently, the program received an important endorsement from a national leader in business. JPMorgan Chase Chairman and CEO Jamie Dimon has donated \$100,000 to Morehouse College for the creation of



a Software Engineering Innovation Lab under Gosha's direction. Gosha said the gift will support the development of a spacious area in which students can brainstorm and work together on group projects as they would at tech firms. The Innovation Lab will include collaboration spaces, a video wall, a digital whiteboard, and quiet spaces for reflection and meditation.

"In the industry, one person doesn't develop Google Maps or Microsoft Word," Gosha said. "You have to work in large teams. This gift will assist us in developing a world-class program for men of color who want to become software developers. Black males have been woefully underrepresented in the nation's computing footprint, and this gift is one small step in changing the narrative."

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CLAFLIN UNIVERSITY RECEIVES GRANT TO ENHANCE TECHNOLOGY IN STEM RESEARCH

Clafin University's growing reputation in STEM (Science, Technology, Engineering and Math) continues to attract funding for research, professional development and new technologies. Clafin has secured a grant for more than \$470,000 from the U.S. Department of Defense to purchase a Xevo G2-XS Quadruple-Time of Flight mass spectrometer, which can measure the accurate mass of molecules in research to detect various diseases and in developing drug targets to cure diseases.

"The recent acquisition of the mass spectrometer is consistent with Clafin's research and STEM agendas," said Clafin University president Dr. Dwaun Warmack. "We want to recruit and retain outstanding STEM students. It is imperative that we offer advanced technology and training that will prepare them for prestigious professional schools, research laboratories and other career opportunities. I applaud Dr. Swinton and his team for developing a comprehensive and compelling proposal that effectively articulated why the mass spectrometer is important to the high-quality research conducted at Clafin. The grant provides a vital resource for preparing Clafin students in STEM disciplines."

According to Dr. Derrick Swinton, interim dean of the School of Natural Sciences and Mathematics, the mass spectrometer has the ability to separate molecules that have similar or the same molecular weight and the ability to find these molecules that may be abundant at low levels. Researchers who are interested in detecting diseases and developing drug targets to cure diseases after detection find different metabolites or proteins that are responsible for certain diseases.

"The mass spectrometer can detect and identify proteins that are responsible for causing types of diseases," said Swinton. "It can differentiate proteins down to the per million level. The spectrometer allows us to find a needle in the haystack in identifying molecules. It has the ability to analyze blood or tissue samples to determine if any levels of drugs or pesticides exist in molecules with pinpoint accuracy. This will help us design drugs that will target a molecule, usually a protein, that is intrinsically associated with a particular disease process," Swinton said.

The mass spectrometer will enhance Swinton's research in finding markers for chronic obstructive pulmonary disease (COPD) in African-American tobacco users. COPD is a chronic inflammatory lung disease that causes obstructed airflow from the lungs.



"Data shows that drugs on the market now that treat COPD are not as effective in the African-American population," Swinton said. "I am looking for targets that can be used to design drugs specifically for African Americans." Although African Americans usually smoke fewer cigarettes and start smoking cigarettes at an older age, they are more likely to die from smoking-related diseases than Whites, according to information on the Center of Disease Control (CDC) and Prevention website.

Swinton's other research priorities include a collaboration with the University of South Carolina School of Medicine and Winthrop University, which involves designing shelf-tissue implants from porcine (pig) tissue for transplantation into humans. This project is funded by the National Science Foundation (NSF) and the South Carolina Established Program to Stimulate Competitive Research (SC EPSCoR), a federal-state-university partnership designed to increase research support for states who have historically received low levels of federal research and development funds.

"This requires analyzing the protein profile of the tissue after it's removed from the pig," Swinton said. "This process also involves removing – as much as possible – cells and proteins from the tissue to prevent a negative immunological response if it is transplanted into human patients. We will use the mass spectrometer to look at the proteins in the tissue after we prepare it for implantation."

Although African Americans usually smoke fewer cigarettes and start smoking cigarettes

at an older age, they are more likely to die from smoking-related diseases than Whites, according to information on the Center of Disease Control (CDC) and Prevention website.

In addition to supporting Swinton's projects, the mass spectrometer will enhance the research and training infrastructure for faculty and students, broaden the participation of women and minorities in STEM disciplines and enable the development of new interdisciplinary and cross disciplinary courses. The spectrometer is one of several state-of-the-art technologies housed at Clafin's Henry N. Tisdale Molecular Science Research Center (MSRC), which opened in 2010. This includes the Bruker BioSpin 700 Megahertz Ultrashield Plus, which can completely breakdown the structural outline of any compound. The combination of Clafin's outstanding STEM faculty and access to these innovative technologies will contribute to improving the quality of the University's STEM graduates.

"Clafin students will train on advanced instruments used in industry, thus preparing them for success in the workforce," Swinton said.

The U.S. Department of Defense (DoD) grant (W911NF-18-S-0006) is supported by the U.S. Army Combat Capabilities Development Command Army Research Laboratory's Historically Black Colleges and the Universities/Minority Institutions (HBCU/MI) program. The program's goal is to expand the involvement of HBCU/MIs in ongoing research at ARL.