

Final Report  
 DOE Award Number: DE-FG02-97ER62480  
 Cycling of DOC and DON by novel heterotrophic and photoheterotrophic bacteria in the ocean  
 Lincoln University

This project involved a collaboration between Lincoln University and the College of Earth, Ocean and Environment at the University of Delaware and was funded under the Department of Energy Biological Investigations – Ocean Margins Program (BI-OMP). Lincoln is a historically black university with a majority of its undergraduate students being African American or black international students; the University of Delaware is a major research institution. The goal was to introduce minority students to marine research so that some of them might pursue Ph.D. or M.S. programs in marine science. A secondary goal was the establishment of an environmental science program at Lincoln including the development of a microbial ecology course.

Each year one or two students from Lincoln spent the summer at the College of Earth, Ocean and Environment in Lewes, Delaware doing research under the supervision of the PI on the Delaware portion of the grant. Following this experience, they returned to Lincoln and continued performing research under the supervision of the PI at Lincoln. During this process, the students were encouraged to prepare posters and present their research at appropriate conferences.

The program was successful in attracting talented and motivated students who were excited about the opportunity to do marine research. The students blended in well with the other undergraduate students who were at Lewes as part of an NSF-funded REU program. All of the students presented their research in poster or oral form; presentations were made at the end of the program in Lewes, an annual poster session at Lincoln, at the regional meeting of TriBeta Biological Honor Society, and at the annual meetings of BI-OMP PIs and students. The goal of getting a significant number to attend graduate school in marine science was not met although there were some successes. Some examples of the post-graduate education of student participants are listed below:

<b>Student</b>	<b>Post-Graduate Education</b>
Ogugua Anene-Maidoh	Currently pursuing an MD/PhD at the Medical College of Wisconsin
Maryanne Arienmughare	Completed a medical degree at Jefferson Medical College
Darren Dolly	Completed a medical degree at Pennsylvania State University College of Medicine at Hershey
Temitayo Adetunji	Completed a medical degree at Meharry Medical College
Candice Johnson	Currently pursuing a Ph.D. in Environmental Engineering at Temple University
Kendrin Dyitt	Completed a master's degree in Environmental Science
Tarron Herring	Completed a veterinary degree at Tuskegee University

With the support and advice of the PI at Delaware, we were able to establish a degree program in Environmental Science at Lincoln. There are two tracks in the major, one in Biology and one in Chemistry. The first four students to complete the major graduated in 2007; there are eleven declared majors among the current undergraduates. As part of this degree, a course in Microbial Ecology was developed; it is a requirement for the Environmental Science degree and an elective for the Biology degree. This course has been taught three times, most recently in the fall of 2009, when there were eleven students in the class. It is taught approximately once every two years.

Once the BI-OMP program ended, the PIs at Lincoln and the University of Delaware sought another source of funding to continue this successful partnership. Building on the BI-OMP model, a proposal was developed and submitted to the Undergraduate Research and Mentoring in Biology Program at NSF and was funded on the second submission. This has allowed for additional students to participate in marine research, a number of whom are Environmental Science majors.

Another benefit of the program at Lincoln was the upgrade of the research facilities. When the grant was first awarded, the PI set up a lab that included several pieces of equipment used in molecular research. A major addition was a fluorescence microscope that was used with selective staining to detect and identify different taxonomic groups of bacterioplankton. The PI was also supported by the grant to take a concentrated two-week course in molecular research methods offered at Smith College.

In conclusion, the BI-OMP Program involving Lincoln and the University of Delaware was successful in many respects. It led to a partnership that continues to provide underrepresented students with the opportunity to experience marine research. It facilitated the establishment of a new degree program at Lincoln in a field in which African-American students are underrepresented. Many of the BI-OMP students went on to post-graduate education with some choosing environmental fields for their studies, while a number of others went into professional fields, mostly medicine. It supported the upgrade of the research facilities at Lincoln, making available pieces of equipment, such as a fluorescence microscope and a PCR machine, that are still being used with undergraduate students.

Respectfully submitted,

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