Project Outcomes Report for
REU Site: Interdisciplinary Program in High Performance Computing
Supported by the National Science Foundation, National Security Agency, and Department of Defense
Dr. Matthias K. Gobbert, Dr. Nagaraj K. Neerchal, Dr. Bradford E. Peercy, and Dr. Kofi P. Adragni
Contact: Dr. Matthias K. Gobbert, 410-455-2404, gobbert@umbc.edu, hpcreu.umbc.edu
Department of Mathematics and Statistics, University of Maryland, Baltimore County (UMBC)

The REU Site: Interdisciplinary Program in High Performance Computing (hpcreu.umbc.edu) in the Department of Mathematics and Statistics at the University of Maryland, Baltimore County (UMBC) is an eight-week residential summer program for undergraduate students majoring in mathematics, statistics, or computer science. This REU Site uses activities that can be grouped into three principal components to develop skills of the future workforce: (1) Structured training in a certificate program teaches fundamental skills in high performance computing through lectures and TA-supported computer labs, with specific tools of Linux, C, MPI, MATLAB, and R. (2) The skills in scientific, statistical, and parallel computing are applied to interdisciplinary research projects posed by scientists from industry, government agencies, or departments outside of mathematics and statistics. (3) The teaching and research are supported by a complete set of highly integrated professional development activities, including team work experience, presentation skills (poster, oral, project update, and 'elevator pitch'), writing skills (abstracts, webpage, and technical report), discussion of professional integrity, topical field trips to agencies such as the NSA and NIH, information on graduate school application, a GRE preparation course, and opportunities for informal contact with faculty, graduate students, and visitors to the program.

Scientific, statistical, and parallel computing skills are critical to the 21st century workforce. Equally crucial are skills in interacting and communicating in teams and working on interdisciplinary projects. This REU Site provides a comprehensive program integrating these elements under the guidance of the faculty mentors and graduate assistants, many of whom have extensive experience with client-focused interdisciplinary consulting through the Center for Interdisciplinary Research and Consulting (circ.umbc.edu). The high performance computing environment is provided by a state-of-the-art distributed-memory cluster in the NSF-supported UMBC High Performance Computing Facility (hpcf.umbc.edu). Its current cluster maya has more than 300 nodes with modern multi-core CPUs and includes hybrid nodes with state-of-the-art massively parallel GPUs designed for scientific computing.

Since the program's inception in 2010, the program served 158 participants in total trained over the eight years. The program's direct federal funding of 114 participants was leveraged to all an additional 44 undergraduates to participate using their own funding or funding from other sources, including through a partnership with UMBC's renowned Meyerhoff Scholars Program (meyerhoff.umbc.edu). The 158 participant demographics include 65 female (39%), 42 African Americans (27%), 23 Asians (15%), 2 Native Americans, and 20 Hispanics (13%), as well as 4 students with disabilities and 3 military veterans. A total of 21 graduate students have assisted the student teams and faculty mentors, thus gaining themselves invaluable experience in project work, interacting with applications researchers, and mentoring in a vertically integrated environment. The program has to its credit 64 publications, comprising 17 papers in reviewed journals for the participants, 4 refereed conference papers, 3 senior theses, and 40 HPCF technical reports publically available at its webpage hpcf.umbc.edu. Three students affiliated with the program have been awarded NSF Graduate Research Fellowships, two undergraduate participants and one graduate student who served as research assistant.

Visit by President Dr. Freeman A. Hrabowski, III to welcome to UMBC our 2016 participants and our clients presenting their projects.

The 2016 Team 5 discusses their project with client Dr. Zana Coulibaly (right) from UC Davis, faculty mentor Dr. Matthias Gobbert (front), and RA Jonathan Graf (back).

The 2016 Team 4 presented an update on their work to client Dr. Arthur Sherman (second from right) at NIH, supported by faculty mentor Dr. Bradford Peercy (left) and RA Janita Patwardhan (right).

Two students from the 2016 Team 4 give one of only five oral presentations at the UMBC Summer Undergraduate Research Fest (SURF).
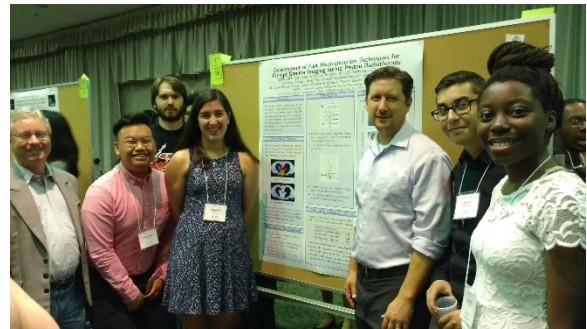
The 2017 Team 6 with client Dr. Jerimy Polf from the UM School of Medicine (center) presenting their team's poster at SURF that features 100+ posters on undergraduate research at UMBC each summer.

Group of all 2017 participants with graduate assistants, faculty mentors, and several project clients after oral and poster presentations at the UMBC Summer Undergraduate Research Fest.