

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
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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 in the sciences, topical field trips to local employers or computing centers such as the NSA, NASA, or NIH, information on graduate school application and a GRE preparation course, and opportunities for informal contact with faculty, graduate students, and visitors to the program. All aspects of the program are conducted by student teams, which is one of the most important experiences participants take away from the program.

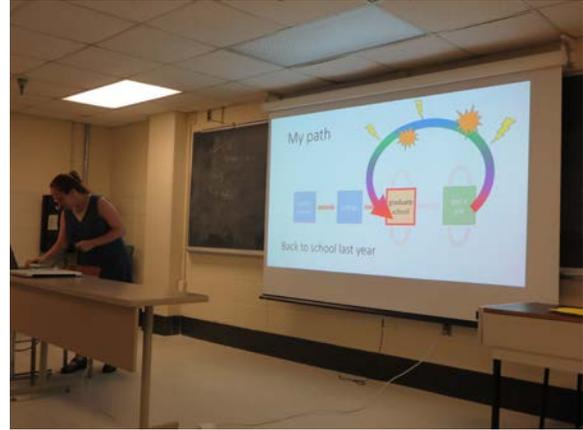
Scientific, statistical, and parallel computing skills are critical to the 21st century workforce. Equally crucial are skills in interacting and communicating in teams, and working on interdisciplinary projects. This REU Site provides a comprehensive program integrating these elements under the guidance 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 may have 240 nodes with modern multi-core CPUs and includes hybrid nodes with state-of-the-art massively parallel GPUs designed for scientific computing as well as cutting-edge 60-core Intel Phi accelerators. The REU Site participants benefit from a complete professional development experience involving scientific, statistical, and parallel computing, interdisciplinary research projects, and integrated development of professional skills. These skills are of vital importance to the workforce of tomorrow and for the national competitiveness of the United States.

Since the program's inception, the number of participants per year has grown from 9 in 2010 to 33 in 2015, with 105 participants in total trained over the six years. The program's direct federal funding of 76 of these was leveraged to allow an additional 29 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 105 participants include 28 African Americans, 14 Asians, 1 Native American, and 13 Hispanics, as well as 3 students with disabilities and 3 military veterans. A total of 16 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 8 papers in reviewed journals for the participants, 3 refereed conference papers, 2 senior theses, and 28 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.



VIP visit by University President Dr. Freeman A. Hrabowski, III to welcome to UMBC our 33 participants and our clients presenting their projects.



One of the graduate assistants (Ms. Ari Rapkin Blenkhorn, with previous jobs as computer scientist in the movie industry) shares with all participants her invaluable experience with a career path that includes working between Bachelor's, Master's, and Ph.D.



One project client (Dr. Jeremy Polf from the University of Maryland School of Medicine) presents his team's problem to all participants.



A participant answers questions from a visitor to her team's poster at the UMBC Summer Undergraduate Research Fest that features 100+ posters on undergraduate research at UMBC each summer.



A research team with faculty mentor (Dr. Bradford Percy, left) discusses details with the client (Dr. Arthur Sherman from NIH, right) after his project presentation to all participants.



Group photo of all 33 participants with graduate assistants, faculty mentors, and several project clients after poster and oral presentations at the UMBC Summer Undergraduate Research Fest.