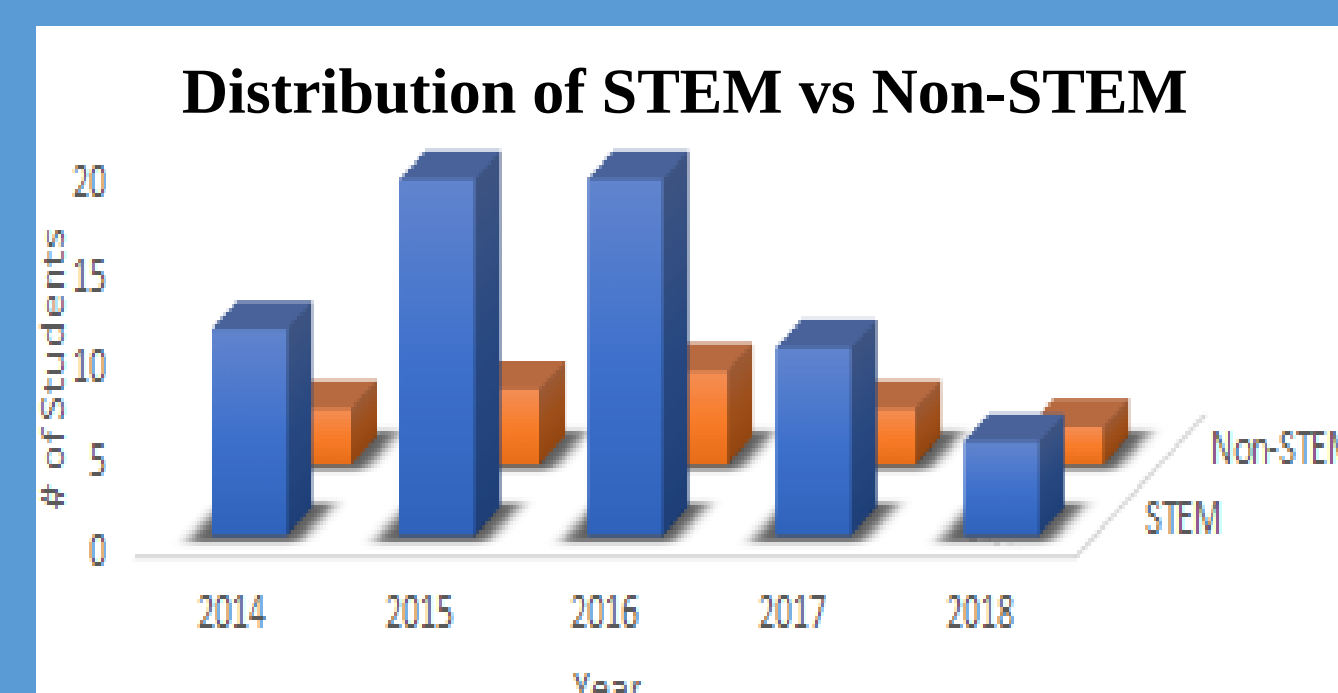


## Abstract

The Nanoscience Project at Hampton University (NanoHU) has responded to the general call to broaden participation of underrepresented groups in science, technology, engineering, and mathematics (STEM) across the globe. Funded by the National Science Foundation, the seven-year project (2012-2019) has established a successful model for preparing underserved populations for engagement in nanoscience and nanotechnology. The NanoHU model is responsible for the formalization of a nanoscience program at Hampton University, a historically black college and university (HBCU) that has in turn, effected multidimensional impact in STEM education beyond the institution. By way of NanoHU, nanoscience is infused into the Hampton University curriculum resulting curricular design and re-design to establish a nanoscience minor. The manner in which the minor has been offered presents an alternative approach to offering minors not directly aligned to a major. NanoHU has also successfully prepared undergraduate students from underserved populations for successful matriculation through STEM programs, in preparation for enrolment in graduate STEM programs. Moreover, NanoHU has been instrumental in increased research activity by undergraduates and faculty as evidenced by increased scholarship. Efforts to communicate the importance of nanoscience to the HU community through seminars resulted in infusion of nanoscience modules in STEM and non-STEM courses including courses in English, Journalism, Ethics and other pre-law courses. NanoHU includes a viable outreach program that has prepared high school students (NanoHU Pioneers) for successful matriculation as STEM majors at the college level, and stimulated STEM interest in the surrounding community. Although established for the specific needs of Hampton University, the innovative NanoHU model promises to be elicit similar successes if replicated at other institutions with a similar construct.

## Introductory Nanoscience Course

Introduction to Nanophysics, Nanochemistry, Nanobiology and Nanotechnology/Nanorobotics



## Nanoscience Minor

Student participants in the Introduction to Nanoscience Course for the years 2014 to 2018; 82 students total.



**“The First Three” (L-R)**

Jody Stiger, III, Breyinn Loftin (NanoHU Scholar) and Kevon Windham

- Established in 2013.
- Created through collaboration with existing Schools, departments and courses.
- Aligned with School rather than departments.
- 22 Students enrolled
- **13 students** earned the minor to date

## Faculty Research & Professional Development



**Nanocomputation and Communications (1) Robot to Robot Communications, (2) Robot Autonomous Maneuvering**  
Mr. Bruce Chittendon (Assistant Professor of Computer Science)



**Nanobots: Bio-inspired Nanoscale Self-Assembly: Evolutionary Nanobots**  
Dr. Moayed Danesahyari (Assistant Professor of Computer Science)



**Nanoeducation: Infusing Nanotechnology into Science Education Methods Courses for Pre-Service Teachers at Hampton University**  
Dr. Shawn Dash (Assistant Professor of Biological Sciences)  
Dr. Clair Berube (Associate Professor, Department of Professional Education)



**Nanoengineering and Nanomaterials: Development of Nanocomposite-Based 3D Printer Ink for Bone Microfluidic Applications**  
Dr. Jerald Dumas (Assistant Professor of Chemical Engineering)



**Nanobiology: Determining the Structural Elements of Peroxidase**  
Dr. Isi Ero-Tolliver (Assistant Professor of Biological Sciences)



**Nanochemistry: Synthesis of Au Nanoparticles for Optical and Bioanalytical Applications**  
Dr. Peter Njoki (Assistant Professor of Chemistry & Biochemistry)



**Nanobiology: Zooplankton and Ichthyoplankton Biodiversity Assessment in the James River Hampton Roads Estuaries**  
Dr. Aurea Rodriguez Santiago (Visiting Research Professor of Marine & Environmental Science)



**Nanochemistry: Development of Biomarker Epitomes for Tuberculosis**  
Dr. Brandy Young-Gqamama (Assistant Professor of Chemistry & Biochemistry)



**Nanoeducation: Research on Learning, Education and Nanoscience (RoLEN)**  
Dr. Jermel Watkins (Assistant Professor of Biological Sciences)

## Notable External Partnerships

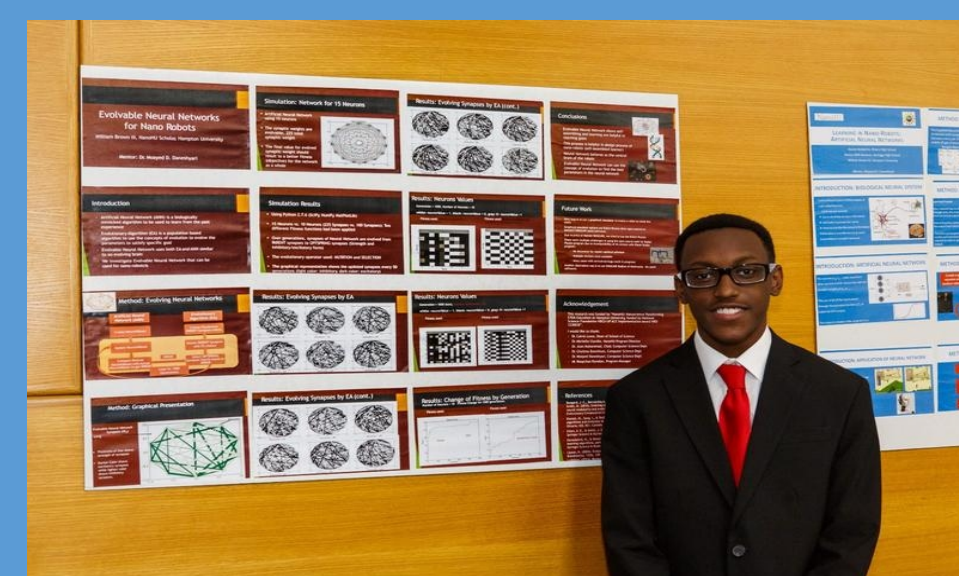
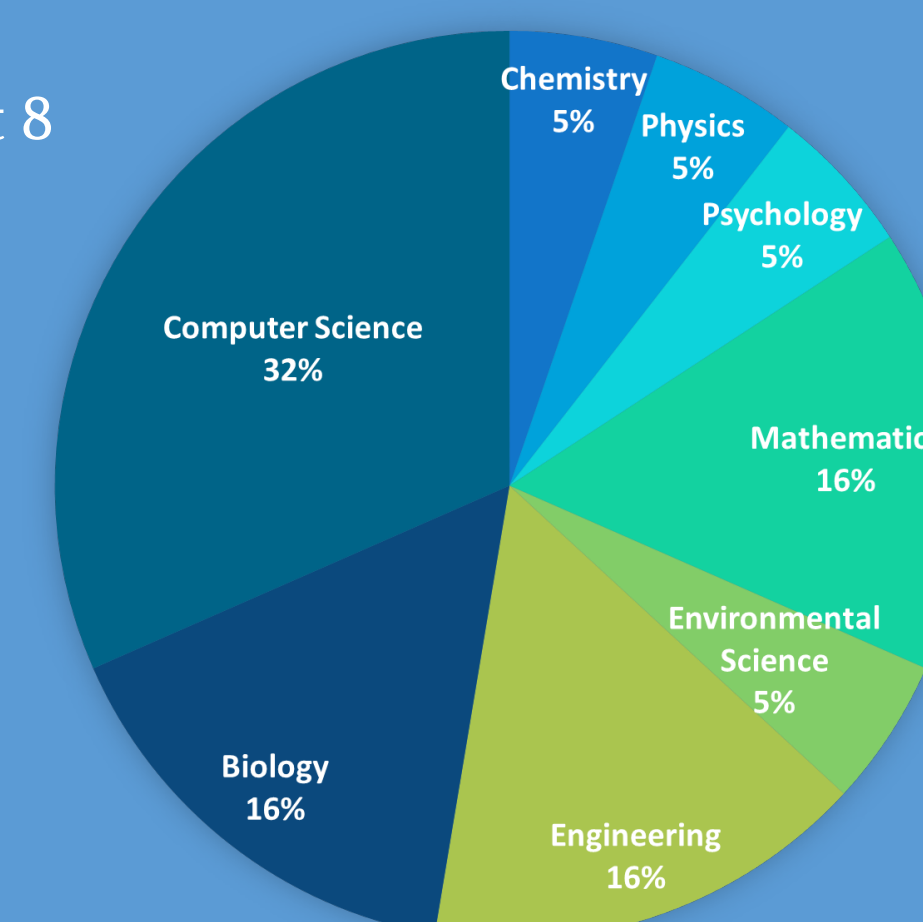
- Brandeis University
- University of North Carolina – Charlotte
- University of Nebraska Medical Center
- Virginia Polytechnic Institute and State University-NanoEarth

## NanoHU Scholars & Fellows and Undergraduate Research

The Scholars (45% male, 55% female) represent 8 STEM degree programs.

Scholars performance metrics are derived from:

- Annual surveys
- Course engagement
- Faculty -advisor connection
- Peer-reviewed publications
- Research presentations and reports
- Seminar participation and engagement



## NanoHU Pioneers Program

2013

2017



## Community Outreach

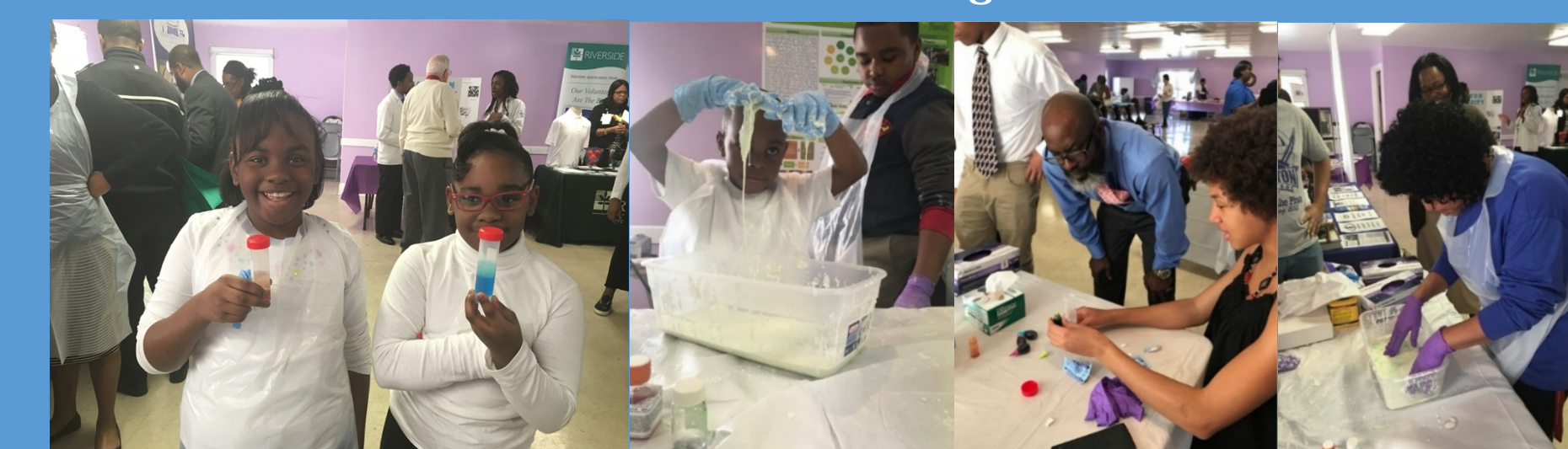
Kiln Creek Elementary School



Barron Fundamental Elementary School



Area Churches and Civic Organizations



## Acknowledgments

We are most grateful for the National Science Foundation's Historically Black Colleges and Universities- Undergraduate Program (HBCU-UP) Achieving Competitive Excellence (ACE) Implementation Award, HRD-1238838, that funds this project. We also recognize the advisory support provided by members of our external and internal advisory board members. External Board members are: Chancellor John Pierre (Southern University Law Center in Baton Rouge, LA); Dr. Patrick Murray (North Carolina A&T, Greensboro, NC); and Dr. Debra Murray, (Baylor College of Medicine, Houston, TX). Internal Board members include: Drs. Halima Ali, Willie Darby, Chutima Boonthum-Denecke, Edison Fowlks, Deidre Gibson, Jose Goity, Paul Gueye, Jean Muhammad, Calvin W. Lowe, Michelle Penn-Marshall, Raymond Samuel, Felix Jaetae Seo, Eric Sheppard, Isai Urasa, Arun Verma., and Donald Whitney. NanoHU would not be possible without the support of the Hampton University Administration, and its community.