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“Scholarship is to be created not by compulsion, but by awakening a pure interest in knowledge.” – Ralph Waldo Emerson

My research focuses on the scholarship of teaching and learning (SoTL), and the scholarship of discovery (basic research). My work emphasizes how to integrate and enhance experiential learning in higher education (e.g. course-based undergraduate research experience, CURE), as well as a STEM Education focus on diversity and inclusion in natural resources through exploring culturally relevant and culturally responsive teaching; and a research focus on environmental health, environmental justice, water quality, and environmental microbiology that explores the ecology of waterborne diseases with an emphasis on water quality. My publications, presentations, and grant proposals demonstrate my ability to develop and implement a viable and relevant research agenda.

Scholarship of Discovery

My scholarship of discovery aims to combine principles and techniques from ecology, environmental health, environmental microbiology and water quality to the study of waterborne diseases. My previous work has focused on pathogen transport in natural streams and watersheds (PhD dissertation), and microbial indicators of water quality in urban drinking water distribution systems (postdoctoral research). My current work seeks to investigate and identify the influence of environmental and anthropogenic pressures on the microbial communities of urban watersheds; this work explores the microbial community composition and functions, as deduced from metagenomic data.

With the development of microbiome studies based on DNA sequencing, the effect of environmental conditions on microbial community composition has begun to be more thoroughly investigated. I was awarded a \$362,865 Research Initiation Award from the National Science Foundation (NSF) entitled, “Metagenomic Approach to Assess Water



Dr. Vereen has been awarded over \$1 million in research grants and awards from agencies including but not limited to the National Science Foundation, Department of Education, and the Environmental Protection Agency.

Quality and Microbial Load Variability of an Urban Watershed,” that not only increased research capacity at Morehouse College, but also provides additional training opportunities for the college’s STEM students. This NSF funded project provides new information on how microbial communities persist and change within an urban watershed using metagenomic techniques. My overarching research questions are: within an urban ecosystem, how do microbial communities vary and how does the diversity of microbial species affect their

function? The specific objectives of this project are: 1) to examine the composition of

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bacterial communities in an urban watershed to identify microbial source and signatures of urbanization relative to a more pristine creek in order to elucidate the effects of human activity and contamination, and 2) describe diversity of the system especially during changing environmental conditions (such as flooding).

As a postdoctoral fellow at Emory University, I was one of the lead investigators on a research team project, *Water Industry Contribution to Epidemiological and Health Effects Studies Involving Distribution System Water Quality* (funded by the Water Research Foundation). This study was a sister project to a US EPASTAR funded study, *Measures of Distribution System Water Quality and Their Relation to Health Outcomes in Atlanta*. The EPA study examined links between health outcomes, quantified through emergency department visits for gastrointestinal illness, to drinking water distribution system water quality and infrastructure characteristics in the City of Atlanta drinking water system. The Water Research Foundation study built on these epidemiological analyses by carrying out microbiological analysis of water samples obtained from various high-risk areas of the distribution system (areas prone to frequent mains breaks, low pressure, or longer water residence time). As an investigator on this project I was responsible for the microbial analysis. I also assisted with the primary management of graduate student training and sample collection and processing. During my first year as an Assistant Professor, this work was completed and published in the *Journal of Applied Microbiology*.

As a researcher at a primarily undergraduate institution, I have successfully recruited undergraduates to study and train in my lab group, sought out mentorship to build collaborations, as well as applied for and received internal and external funding as I continue to strategically build a manageable and sustainable research program. I take pride in that I have been successful in training a diverse group of undergraduate and postdoctoral fellows that have gone on to pursue graduate and professional school, medical school, careers in academia and the private sector, and the military. As a graduate of a small liberal arts historically black college (SC State University) and a former undergraduate researcher myself, I recognize the highly beneficial value of an undergraduate research experience for a student in deciding to pursue a scientific career, and especially the impact it can have on an underrepresented minority person.



Undergraduate student research trainees conducting research under the mentorship of Dr. Vereen.

My professional peers in the fields of environmental health and ecology have shown that they value and recognize my expertise as a scholar and peer-reviewer. Journals that I have been a reviewer for include *WIREs Water* (Wiley interdisciplinary reviews), *Journal of Applied Microbiology*, *Computational and Structural Biotechnology*, and *Science of the Total Environment*. I have also served as a reviewer for several NSF panels (GEO, DEB, HBCU Up), and I also accepted a nomination to become an Affiliated Investigator as part of the Center for Global Safe Water Sanitation and Hygiene (CGSW). The CGSW is a consortium of Atlanta-based WASH researchers and practitioners including Emory

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University, Georgia Tech, CARE, the Centers for Disease Control and Prevention (CDC), The Carter Center, and The Task Force for Global Health (TFGH). I have maintained professional membership in the following organizations: Association for Biology Laboratory Education (ABLE), National Science Teachers Association (NSTA), National Research Mentoring Network (NRMN), National Society of Leadership and Success, American Society for Microbiology (ASM), Southeastern Branch ASM, Ecological Society of America (ESA), Omicron Delta Kappa (ODK) National Leadership Honor Society, and Beta Kappa Chi (BKX) National Scientific Honor Society. Additionally, I have also been recognized among the 1000 Inspiring Black Scientists in America from Cell Press and Cell Signaling Technology.

Going forward, I plan to continue carrying out research on microbial water quality that spans the fields of microbial ecology and public health. My long-term research goal is to develop a research program that is focused on the use of metagenomics and other molecular tools to study the structure and dynamics of various microbial ecosystems. I also recognize that research is enriched both by students and by professors from unrelated fields who can bring fresh opinions and points of view to their projects. Therefore, it is important to me that I conduct collaborative research that allows me to work with specialists in a variety of fields, as well as to include students in the research process. To this end, I plan to continue to seek out opportunities both internal and external to collaborate as I continue to build and develop my research program.

Scholarship of Teaching and Learning

“Scholarly teaching is what every one of us should be engaged in every day that we are in a classroom, in our office with students, tutoring, lecturing, conducting discussions, all the roles we play pedagogically. Our work as teachers should meet the highest scholarly standards of groundedness, of openness, of clarity and complexity. But it is only when we step back and reflect systematically on the teaching we have done, in a form that can be publicly reviewed and built upon by our peers, that we have moved from scholarly teaching to the scholarship of teaching.” Carnegie Foundation for the Advancement of Teaching (Lee Schulman, President)

As I continue to develop as an instructor, I have become more intentional in balancing my scholarly approach to teaching to include scholarship of teaching and learning (SoTL). My scholarly approach to teaching has involved reading about and incorporating where applicable new teaching methodologies, reflecting on my own teaching practices, attending workshops and seeking out student and peer feedback on my instruction. Though effective, by contrast, the SoTL involves a systematic engagement and analysis of research questions related to instruction and student learning that are shared to advance the field of teaching and learning. As an example, ‘How do I know if my students are achieving the specific learning goals for a course?’ Class evaluations and observations provide excellent feedback about student satisfaction and teaching style, but

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they don't provide the important detail of how much my students are learning and what activities or teaching strategies best engender deeper learning and understanding of the subject matter.

To support my scholarly approach to teaching and SoTL, I have written proposals for and been awarded Title III funding, as well as seeking out external funding support. The purpose of the Title III program is to impact institutions through *“financial assistance to establish or strengthen the physical plants, financial management, academic resources, and endowments.”* In an effort to improve and assess student learning, there has been a push to increase the incorporation of course-based undergraduate research experiences (CUREs) and discovery-driven modules that contain real-world relevance into lecture and laboratory curricula. In the sciences in particular, experiential and inquiry-based learning has been widely promoted to increase literacy and skill development. The proposals that I have submitted to Title III were for equipment and supplies to support my development of CUREs and inquiry-based labs and activities in several of my courses including Environmental Studies, the Men’s Health course that I developed, and the Microbiology lab course that I co-developed.

In education, new technologies are used to improve the process of learning. Virtual reality, or VR, is taking off in education with an increasing number of schools adopting the technology. From the youngest digital natives entering kindergarten to college and university students preparing to enter the workforce, VR technology is penetrating teaching and learning models across the globe. More formally, VR technology is an immersive and interactive technology that simulates a computer-generated environment, allowing users to experience a sense of presence and interact with virtual objects and surroundings.

Morehouse, like many other schools and universities during the COVID-19 pandemic closed and transitioned to online learning. It was during this time that a pivot occurred where I, along with a few of my other colleagues transitioned from online Zoom classrooms to Morehouse’s “Metaversity” digital twin. Morehouse became the world’s first Metaversity,



Morehouse College students use Meta's virtual reality headsets to enhance their learning in a microbiology class taught by Dr. Vereen.

an interactive, virtual learning space based on real or imagined environments. While there have been previous studies demonstrating improved student engagement with VR, research focusing on learning outcomes, intervention characteristics, assessment measures and the ethical considerations of VR in the college classroom are sparse. My scholarship in this area focuses on exploring and understanding the effect of VR on students’ experiential learning beyond the novelty of simply being in the metaverse. This

interest has been shared in presentations and publications and is an area that has tremendous future growth prospects for teaching and learning.

My interest in improving student engagement has also led me to explore culturally relevant and culturally responsive teaching. I have led workshops and presentations on

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this topic focused on course design and teaching as an invited presenter at both conferences and academic institutions to include the American Association for the Advancement of Science (AAAS), ABLE, the Black Doctoral Network (BDN), the Ecological Society of America (ESA), Morehouse College and the Massachusetts Institute of Technology (MIT). I have also published in this area sharing results, expertise, and inquiry from my courses in SoTL journals. Additionally, I have published teaching modules on the Quantitative Undergraduate Biology Education and Synthesis (QUBES) platform. QUBES is an open and inclusive virtual space for sharing STEM classroom activities and resources, discussing teaching and the adaptation of educational materials to specific institutional contexts, and working together to develop new ideas and insights that contribute to STEM education reform. I have also sought out external funding from the National Science Foundation (NSF) with collaborators to pursue this line of research further.

As I continue my scholarship both in SoTL and discovery, I recognize that scientific inquiry advances through a mixture of asking intriguing questions and performing scientifically rigorous and repeatable experimental studies. It is important to me that I contribute to the advancement of my field of microbial ecology by tackling interesting questions with innovative methods, and that I also contribute to the advancement of education and instruction by also tackling interesting questions with innovative methods. In doing so, through my own research, the education of students, and continued mentorship and advancement of colleagues (e.g. Postdoctoral fellows and undergraduate researchers) we will all collectively elevate the field of microbial ecology, science education, and ensure the success of the next generation of researchers, scholars, and thought leaders.