Executive Summary: Host-Microbe Interactions in Health, Disease and Environment

Globalization has advanced industrialization, technology, and human mobility but also created health challenges associated with rapid rates of sociological, biological and environmental change. **Integrative Environment-Health Sciences** (IEHS) phenomenon, including One Health, Conservation Medicine, Eco-Health and Planetary Health, view human health as interdependent with that of other living species and the environment. Scientific study of host-microbe interactions is central to our understanding of health, disease and our environment.

UNC Charlotte is well positioned to expand a key area of research that is critical to environmental and human health and becoming more needed as new climate change and migration patterns emerge. **Host-microbe interactions** describe how microbes (bacteria, fungi, algae, protozoa) sustain themselves within hosts at molecular, cellular, organismal, and population levels. Many of these interactions result in human infections or disease (such as malaria and COVID-19) or other organismal afflictions (such as coral bleaching and agriculture crop disease). Understanding host-microbe interactions is central to our understanding of infectious diseases as well as their treatment and prevention. The development of novel drugs, vaccines, other therapeutics, and genetically-modified crops to prevent transmission will be dependent on knowledge gained by scientific study in this area. Studies must be highly interdisciplinary integrating biologic and biochemical inquiry, genomics, public health, mathematics and statistics.

UNC Charlotte already possesses a critical core group of investigators who demonstrate a consistent track record of research excellence in the area of host-microbe interactions. This collective group has been extremely successful in generating extramural funding for cutting-edge research that also greatly advances the undergraduate and graduate education mission of UNC Charlotte. Several of these faculty are members of the Bioinformatics Research Center, and several of these faculty are obtaining appointments with the School of Data Science that has interests in large data set analysis and the ethical and social obligations considerations that come with it. These align with “Big Data” initiatives on campus.

The key goals of this core group are to (1) understand phenomena related to host-microbe interactions and infections, (2) apply basic biological and biochemical knowledge to situations involving human, animal, and plant diseases, and (3) establish translational approaches cohesive public health or world environmental programs. At the organismal level this group studies how immune systems respond to infections and identify genetic and environmental factors that influence these responses. At the microscopic level this group studies how individual microbes invade host cells and cells respond. By combining approaches, this group and all collaborating labs, centers, and collaborators on and off campus may identify changes in the immune system that predispose individuals to infections, and develop immunomodulatory approaches to stimulate patients’ immune systems as a defense against infections, and work to protect important agro-systems and ecosystems from permanent harm.

Future investment and resources in this area will significantly advance UNC Charlotte’s national and international collaborations and global reputation. Investments include additional faculty with expertise in host-microbe interactions; infrastructure expansion to include core facilities for imaging, proteomics, informatics, and translational research; and increased support for curriculum development and hands-on research experiences of students. An integrated group focused on host-microbe interactions will provide leadership in environmental health research, promote investigation of the interactions between environment and microbes, enable progressive translational, clinical, and population-based research projects that address global environmental health concerns, and develop the next generation of environmental health researchers.