

Development of Next Generation Biologics through Microphysical Systems

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Rapidly rising healthcare costs are placing a significant burden on our economy, putting healthcare out of reach of many people, and further straining the ability of the healthcare system to provide quality healthcare for underserved communities, both nationally and globally. The vision is to create a world where human, animal, and plant diseases can be readily detected, disease mechanisms can be accurately and quickly deciphered, emerging threats can be predicted, and new therapeutics and vaccines can be rapidly developed, all at low cost, thus ultimately providing accessible and affordable healthcare to the globe. The core enabling technological innovation is in developing in vitro microsystems that closely mimic the physiology of whole organisms, and in developing lab-on-a chip systems that are high throughput, accurate, flexible, and low cost. The proposal's initial focus application areas for Microphysiological Systems that represents the One Health concept will be 1) neurodegenerative disease (e.g., Parkinson's disease, Multiple Sclerosis, and Alzheimer's); 2) the immune system; and 3) environment and the microbiome. The developed systems and their applications will be more broadly expanded and adapted to solving other health problems of high societal importance. Nineteen faculty represented five schools/colleges in this endeavor.

The potential long-term societal impacts on the proposed research are both broad and transformative. First, the microphysiological systems developed under the auspices of this proposal will address significant issues in human, animal, and plant health, including mechanisms mediating microbial/viral pathogenesis, neural development and degeneration, and immune system functions. Second, it is expected that this work will result in technological innovations with significant commercialization potential. As such, this work will have the potential to impact society through both public sector innovations and private sector products. Third, the proposed initiative will support the training of undergraduate, graduate students, and post-doctoral trainees and will bring together a highly motivated and creative team of investigators.

Based on the existence of several federal funding programs and anticipation of more funding in the relevant areas, external funding from federal funding agencies such as DARPA, DoD, DTRA, NIH, NSF, and EPA will be pursued along with private industry. Initial focus will be toward multi-PI investigator grants and medium-size program projects. As our multidisciplinary multi-college efforts mature, we anticipate pursuing larger center-level projects in the future.

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