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BIOGRAPHICAL SKETCH

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NAME: DuBois, Eric

eRA COMMONS USERNAME (credential, e.g., agency login): DUBOIS.ERIC

POSITION TITLE: Graduate Student Research Assistant

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Start Date MM/YYYY	Completion Date MM/YYYY	FIELD OF STUDY
Brown University, Providence, RI	BS	09/2016	05/2020	Biomedical Engineering
Boston University, Boston, MA	PhD	09/2020	*In Progress*	Biomedical Engineering

A. Personal Statement

I am a predoctoral trainee in the PhD graduate program in Biomedical Engineering at Boston University (BU) developing expertise in biomaterials and neurobiology. Over the course of my tertiary education, I have actively sought to develop the skills required for the engineering of impactful biotechnology that can improve healthcare outcomes. As an undergraduate researcher, I worked with Assistant Professor Ian Wong of Brown University, studying tissue engineering and cancer metastasis with a focus on designer biomaterials. Through this experience, I gained a strong background in biomaterial characterization, 3D printing, and traditional fabrication techniques. During my time at Brown, I engineered new nanocomposite polymer matrices with improved mechanical properties that permitted the design of complex scaffolds with unprecedented control. This research was published in *Carbon* (2019). Building upon this work, I next investigated the engineering of polymer matrices to exhibit emergent functions such as adhesion and actuation in response to a change in salt concentration. These results were published in *Polymer Chemistry* (2019). I have presented my work at numerous international conferences including an invited oral presentation at the 2019 Material Research Society Conference and a poster presentation at the 2019 Biomedical Engineering Society Conference.

I am seeking to build upon this training as a doctoral student at Boston University. I have transitioned to using my biomaterials skills for the study of brain and spinal cord disorders in the Glial Engineering Lab under the mentorship of Assistant Professor Tim O'Shea. Our work focuses on creating new synthetic biomaterials that can be used to improve therapeutic outcomes in central nervous system injury and disease. These materials act by regulating the functions of glia cells, which are important populations of support cells in the central nervous system. In my graduate studies, I am seeking to make significant contributions in better defining the microenvironment observed in the lesion core of central nervous system injuries and identifying material properties or compositions that mitigate the negative effects of the inflammatory response on axonal regeneration. Through my predoctoral training, I will expand my repertoire of synthesis and material characterization techniques, while also developing proficiencies in cell culture and *in vivo* models of brain and spinal cord disorders. Furthermore, I will learn immunohistochemical techniques and RNA-quantification methods that form the dominant biological readouts used in the lab. As part of my initial work, I am employing green chemistry principles, focusing on the use of enzyme-catalyzed reactions to synthesize a library of monomers. These monomers will then be to create block copolymers that can self-assemble into nanoparticle and hydrogel structures. I am exploring these polymers as carriers and support scaffolds for neural progenitor cell transplantations, as part of a strategy to promote glia-based repair of spinal cord injury and stroke. I am excited for this new direction of my research and believe that my time with Professor Tim O'Shea will help to improve my skills as a researcher and push me closer to my goal of biotechnology development.

B. Positions and Honors

Positions and Employment

2020 – Present	Graduate Student Research Assistant, Boston University
2017 – 2020	Undergraduate Researcher, Brown University
2017 – 2020	Teaching Assistant, Brown University School of Engineering
2018 – 2020	Manager, Brown Design Workshop
2019	Teaching Assistant, Brown Science Prep

Other Experience and Professional Memberships

2019 – Present	Member, Biomedical Engineering Society
2019 – Present	Member, Materials Research Society
2019 – Present	Member, NACE International

Honors

2019	Scholarship, DiMase Summer Internship award for most outstanding junior in engineering
2019	Scholarship, Better Business Bureau Student Ethics
2016 – 2018	Scholarship, New Hampshire Electric Cooperative Foundation

C. Contributions to Science

My contributions to science fall under two main periods of work: my undergraduate research and my work as a graduate researcher.

1. **Undergraduate Research:** There is a need to develop stimulus-responsive polymer systems for both synthetic applications, such as soft robotics and biological applications, such as the design of hierarchical tissue-engineered structures. These systems behave in an active manner, having programmed responses to external stimuli, allowing us to better recapitulate behaviors exhibited by natural polymer systems. Throughout my time performing undergraduate research, I worked with Professor Ian Wong of Brown University studying methods to build complex, 3D tissue-engineered structures as well as both actuating and reversibly adhesive systems for soft robotics. For my first project, which was published in *Carbon* (2019), I was in-part responsible for the design, experimentation, analysis and dissemination of this work. I specifically was responsible for the pattern fidelity and anti-fouling testing of an alginate-graphene oxide composite. This project focused on the development of a more robust, nanocomposite alginate hydrogel for stereolithographic printing. Following this project, I optimized a dual-polymer system that could be readily printed by stereolithography and used for ionic actuation or microfluidic applications. As part of this project, I ran assays to optimize the precursor solution to have ideal mechanical and optical properties for stereolithographic printing. Furthermore, I aided in the design and testing of hydrogel-based gripper and microfluidic systems. Using my fabrication experience, I designed a variety of 3D-printed test setups to aid in the creation of a hydrogel gripper and perfusion of a hydrogel microfluidic. This project was particularly exciting as I had a significant role in the design of the work, its subsequent experimentation and the eventual synthesis of our 2019 Polymer Chemistry manuscript. I presented a poster highlighting the potential future directions and implications of this work at the Biomedical Engineering Society Conference and was also able to present this project orally at the Materials Research Society Conference.
    a. Valentin, T. M.; DuBois, E. M.; Machnicki, C. E.; Bhaskar, D.; Cui, F. R.; Wong, I. Y., 3D printed self-adhesive PEGDA–PAA hydrogels as modular components for soft actuators and microfluidics. Polymer Chemistry 2019, 10 (16), 2015-2028, DOI: 10.1039/C9PY00211A.
    b. Valentin, T. M.; Landauer, A. K.; Morales, L. C.; DuBois, E. M.; Shukla, S.; Liu, M.; Stephens Valentin, L. H.; Franck, C.; Chen, P.-Y.; Wong, I. Y., Alginate-graphene oxide hydrogels with

enhanced ionic tunability and chemomechanical stability for light-directed 3D printing. Carbon 2019, 143, 447-456, DOI: doi.org/10.1016/j.carbon.2018.11.006.

c. DuBois, E. M., et al. Customizable, Adherable Hydrogels for Cell Interaction and Drug Release. BMES annual meeting; 2019 October; Philadelphia, PA.
d. Valentin, T. M.; DuBois, E. M., et al. 3D printed self-adhesive PEGDA–PAA hydrogels as modular components for soft actuators and microfluidics. BMES annual meeting; 2019 December; Boston, MA.

2. **Graduate Research**: My current graduate research is focused on central nervous system (CNS) injury and repair. It is well understood that following traumatic injury to the CNS, there is a permanent loss of function associated with this region of damage. Furthermore, subsequent repair and regeneration via inherent biological mechanisms is insufficient to recover functionality. Therefore, there is a need to design a set of tools to aid in the regeneration of axonal pathways and mitigate damage beyond the initial injury. As such, I am studying on the use of biomaterial scaffolds to manage the inflammatory response and enable stem cell survival in the lesion core of central nervous system injuries. I believe that this research will help define the biomaterial properties required for cell survival in the lesion core and lead to successful reinnervation following injury. I am currently working to develop synthetic, polysaccharide-based biomaterials that may enable facilitate this permissive healing environment. Specifically, I am seeking to utilize enzymatically functionalized polysaccharide and nucleoside monomers in the creation of novel copolymers. These copolymers will serve as a scaffold to modulate the microenvironment of the lesion core associated with the CNS injury and support a neural progenitor cell-based therapy.