BIOMEDICAL & VETERINARY SCIENCES

GRADUATE PROGRAM

ANNOUNCES

The Master of Science Seminar and Examination of

Catherine “Kathy” Barron

“Effects of Trimethylamine N-Oxide on Mouse Embryonic Stem Cell Properties”

Tuesday, July 14th, 2020
1:00PM
Zoom

Bio

Originally from San Diego, California, Catherine (Kathy) has lived in several states growing up. She earned her BS (Biochemistry and Spanish) at Virginia Tech in 2016 and conducted undergraduate research in Dr. Chang Lu's lab in the Chemical Engineering department where she built microfluidic devices for epigenomic profiling. Following her undergraduate education, Kathy attended UMBC in Baltimore, Maryland for a summer REU program in the department of Biochemical Engineering in Dr. Erin Lavik's lab where she worked on a team to build PEG-based retinal tissue scaffolds. Afterward, she joined Dr. He's lab as a research technician for two years before transitioning into the BMVS graduate program as a master's student in Dr. He's lab. Following her defense, Kathy plans to continue her career in biomedical science in industry. She will be moving to Raleigh, North Carolina to begin to explore her future career options.

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Lay Language Abstract

Trimethylamine N-oxide (TMAO) is a metabolite that is produced by the bacteria in the gut after the consumption of specific dietary ingredients (e.g., choline, carnitine, betaine). These ingredients are commonly found in meat and dairy products, and thus make up a large part of the average American diet. Recently, it was discovered that high TMAO levels in the bloodstream put people at an increased risk for heart disease, neurodegenerative diseases (e.g., Alzheimer's Disease), diabetes, stroke, and chronic kidney disease. At the cellular level, there is evidence that TMAO increases inflammation and the production of oxygen radicals, which causes cells to lose their function and promotes the onset of disease. TMAO has been well studied in adult cell types; however, no one has investigated whether TMAO will impact cells of the early embryo. This project aims to explore the impact of TMAO on mouse embryonic stem cells (mESCs), which are cells that represent the early stage of embryonic development and are critical for proper development of the final offspring. In addition, mESCs may also help to provide insight into how TMAO impacts other stem cell types, some of which are present throughout the entire human lifespan and play an important role in the body's ability to repair itself and maintain overall health. My project demonstrated that TMAO does not impact the overall health of mESCs under normal conditions, which signifies that TMAO generated by a pregnant mother may not directly impact the early embryonic stage of development. Further studies should be conducted to determine the potential impact of TMAO on late stages of embryonic and fetal development. Next, to simulate diseased conditions, the mESCs were treated with extremely high concentrations of TMAO in order to determine what concentration of TMAO will negatively impact these cells. It was found that at 5mM TMAO, mESCs begin to lose their basic properties and become dysfunctional. They are impaired in their viability, growth, ability to become other cell types, and in their metabolic activity. These mESC properties are shared with several types of adult stem cells, and therefore, these findings help to provide insight into how TMAO may impact stem cells found in the adult body which are exposed to a lifetime of high TMAO levels. In the future, we would like to further explore the impact of TMAO on mESCs at the molecular level as well as examine the direct impact of TMAO on other stem cell types.

Publications

Haring, A., Jiang, S., **Barron, C.**, Thompson, E., Sontheimer, H., He, J-Q., Jia, X., Johnson, B. 3D bioprinting using hollow multifunctional fiber impedimetric sensors. Biofabrication. [published online ahead of print, 2020 May 20].

He, J-Q., **Barron, C.** Signaling pathways in modulation of tissue and organ regeneration in vertebrates. Semin Cell Dev Biol. 2020; 100:1:1-2.

Barron, C., He, J-Q. Alginate-based microcapsules generated with the coaxial electrospray method for clinical application. J Biomater Sci, Polym Ed. 2017;28(13):1245-1255.

Chen, M., Fan, H., Ledford, B., Farah, Z., **Barron, C**., Liu, Z., He, J.-Q. Impacts of femoral artery and vein excision versus femoral artery excision on the hindlimb ischemic model in CD-1 mice. Microvasc Res. 2017;110:48-55.

Ledford, B., Simmons, J., Chen, M., Fan, H., **Barron, C.**, Liu, Z., Van Dyke, M., He, J-Q. Keratose hydrogels promote vascular smooth muscle differentiation from c-kit positive human cardiac stem cells. Stem Cells Dev. 2017;26(12):888-900.

Presentations

Barron, C., Zheng, Y., Paul, S., He, J.Q. 30th Annual Research Symposium, November 2019, Blacksburg, Va. Effects of Trimethylamine N-Oxide on Mouse Embryonic Stem Cells. Selected for oral presentation.

Barron, C., Zheng, Y., Paul, S., He, J.Q. American Physiology Society, October 2019, Washington, DC. Effects of Trimethylamine N-Oxide on Mouse Embryonic Stem Cells. Awarded outstanding poster presentation.

Barron, C., Novo, D., Edgar, K., He, J.Q. American Physiology Society, October 2018, Washington, DC. Comparison of Stem Cell-derived Cardiomyocyte Efficiencies between Embryoid Body and Monolayer Format. Poster presentation.

Barron, C., Novo, D., Edgar, K., He, J.Q. HBCU/MSI Research Summit, October 2018, Blacksburg, VA. Degradable Alginate-Based Microcapsule for Potential Delivery System of Mouse Embryonic Stem Cell-Derived Cardiomyocytes in the Treatment of Heart Disease. Poster presentation.

Barron, C., Novo, D., Edgar, K., He, J.Q. Life Science Forum, VTCRI, March 2018, Roanoke, VA. Degradable Alginate-Based Microcapsule for Potential Delivery System of Mouse Embryonic Stem Cell-Derived Cardiomyocytes in the Treatment of Heart Disease. Poster presentation.

Barron, C., Chen, M., Ledford, B., Goldstein, A., Edgar, K. Tissue Engineering and Regenerative Medicine (TERMIS), December 2017, Charlotte, NC. Development of High Throughput Platforms for Generating Cardiomyocytes from Mouse Embryonic Stem Cells. Selected for oral presentation.

Awards and Academic Achievements

Outstanding Poster Presentation at the 6th Annual Meeting of the Greater Washington DC Chapter of the American Physiological Society. Oct. 28, 2019

Examination Graduate Committee

Major Advisor/Chair:

Jia-Qiang He, PhD
Professor, Department of Biomedical Sciences & Pathobiology

Graduate Advising Committee Members:

Dongmin Liu, PhD
Professor, Department of Human Nutrition, Foods, and Exercise

Robert Gourdie, PhD, FAHA
Professor, Virginia Tech Carilion and Wake Forest University
Director of the Center for Heart and Regenerative Medicine, VTCRI

Willard Eyestone, PhD
Adjunct Professor, Virginia-Maryland College of Veterinary Medicine
Senior Project Manager, Revivicor, Inc.

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