COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

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for the degree of Doctor of Philosophy (Ph.D.)

"Application of Organ-on-a-chip Technology for Mass Transport Analysis in Physiological and Pathological Conditions"

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Virtual Dissertation

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ABSTRACT OF DISSERTATION
Application of organ-on-a-chip technology for mass transport analysis in physiological and pathological conditions
Mass transport is important for all biological functions to protect the cell's internal environment and to keep its balance of salts, nutrients, and proteins within a range that keeps the cell and the organism alive. We are motivated to study two different types of mass transport, glucose and oxygen that are critical in human system. Specifically, this study focused on mass and oxygen transport in human placenta and oxygen transport in transfusion of artificial oxygen carriers. Studying these processes in vivo or ex vivo are difficult due to ethical or technical challenges.
In this dissertation, Organ-on-a-chip devices were used to simulate placental barrier and blood vessels. In first device, 3D placenta–on-a-chip device consists of a polycarbonate membrane and two Poly dimethylsiloxane microchannel was used. Human umbilical vein endothelial cells (HUVECs) were cultured in microfluidic devices and mass transport was measured. In the second device, 3-lane OrganoPlate was used to develop the placental barrier model. The human umbilical vein endothelial cells (HUVECs) and trophoblasts cells cultured in two microchannels on both sides of polycarbonate membrane (first device) and extracellular matrix gel (second device) to mimic the placental barrier in vitro. Finally, the glucose transfer across the placental barrier affected by malaria was investigated. The results of this study can be used for better understanding of Placental malaria (PM) pathology and development of models useful in studying potential treatment of PM.
In addition, a numerical model was developed to measure the oxygen transfer across the membrane. The effects of flow rate and membrane porosity on oxygen transfer across the placental barrier are studied. Finally, synthesis of artificial oxygen carrier from polymer was studied. A gel-assisted dehydration method was used to synthesize the artificial oxygen carriers. poly (ethylene oxide)-b-poly (butadiene) PEO-PBD polymersome was used to generate polymersome membrane. This method can be used for encapsulating the Hemoglobin and generating the artificial oxygen carriers AOCs.

BIOGRAPHICAL SKETCH
Born in Tehran, Iran
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CONCERNING PERIOD OF PREPARATION
& QUALIFYING EXAMINATION

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Qualifying Examination Passed: Spring 2018

Published Papers：

B. Mosavati, A Oleinikov, E Du, 3D Microfluidics-Assisted Modeling of Placental Nutrient Transport in Malaria, Scientific Reports, 2022, (under review).

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