BioNanofluidics for Drug Screening, Disease Diagnosis, Medical Device Design, and Personalized Medicine

Yaling Liu

Professor

09/15/2020

LEHIGH UNIVERSITY | Department of Bioengineering

Brief Bio of Yaling Liu

- **ASME Fellow, Associate editor of Journal of Medical Device**

- **Education**
  Northwestern University, Department of Mechanical Engineering, PhD 2006

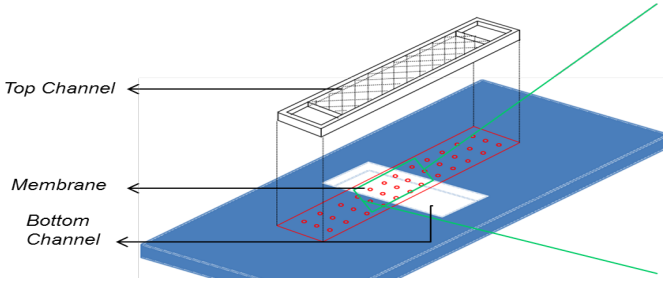
- **key publications**

1. S. Wang, Y. Zhou, X. Qin, S. Nair, X. Huang, Y. Liu, “Label Free Detection of Rare Circulating Tumor Cells by Image Analysis and Machine Learning”, Scientific Report, in press, 2020
2. M. Razizadeh, M. Nikfar, R. Paul, Y. Liu, “Coarse-Grained Modeling of Pore Formation, Growth, and Reseal on the Red Blood Cell Membrane Under Large Dynamic Deformations”, Biophysical Journal, 119 (3): 471-482, 2020
3. C. Uhl, W. Shi, Y. Liu, “Microfluidic Device for Expedited Tumor Growth Towards Drug Evaluation” Lab on a Chip, 19, 1458-1470, 2019
4. W. Shi, S. Wang, A. Maarouf, R. He, Y. Doruk, Y. Liu, "Magnetic Particles Assisted Capture and Release of Rare Tumor Cells using Wavy-herringbone Structured Microfluidic Devices", Lab on a Chip, 17, 3291-3299, 2017

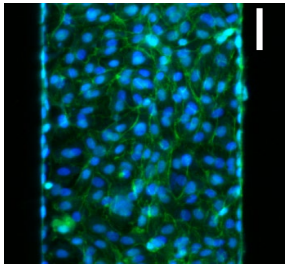
- **Keywords for research**

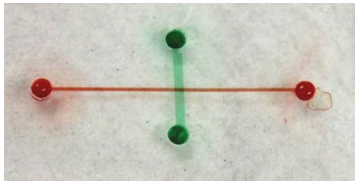
  Biotransport, Microfluidics, Nanomedicine, Cell Mechanics, MEMS, NEMS

Biomimetic Drug Evaluation Platform



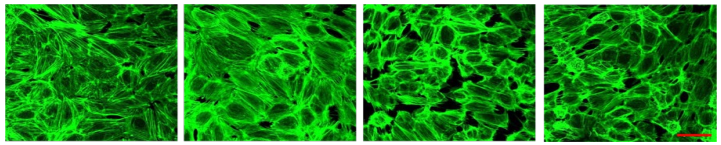
Nanoparticle binding on biomimetic blood vessel

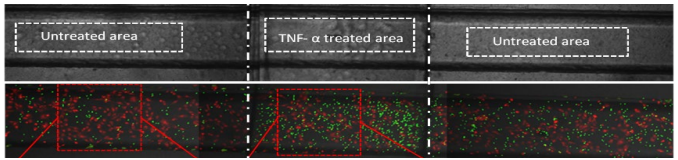




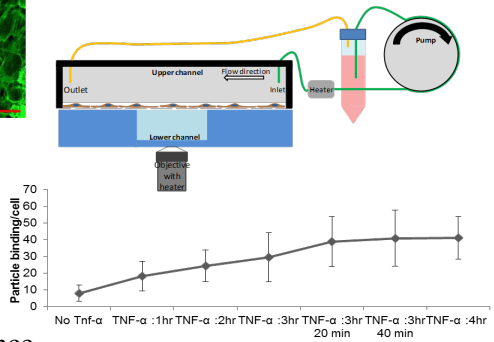
We developed cell-seeded microfluidic chips for evaluation of various nanoparticles drug carriers

endothelium coated to mimic blood vessel

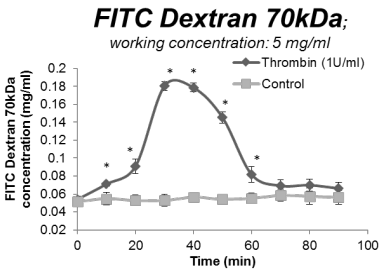




Binding distribution of ICAM-1 coated 210nm fluorescence nanoparticle on anti-ICAM-1 coated microfluidic channels

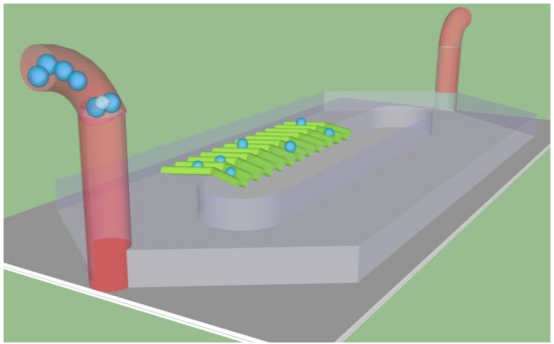


Real-time particle binding study under flow

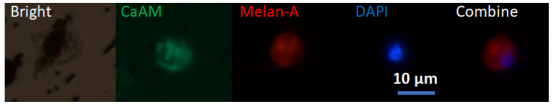


Vascular Permeability dynamics

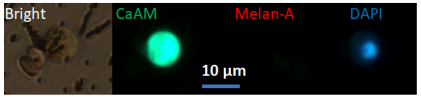
Cancer Diagnosis and Personalized Medicine



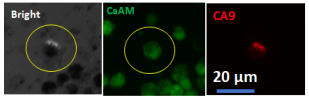
A CTC from MM-05



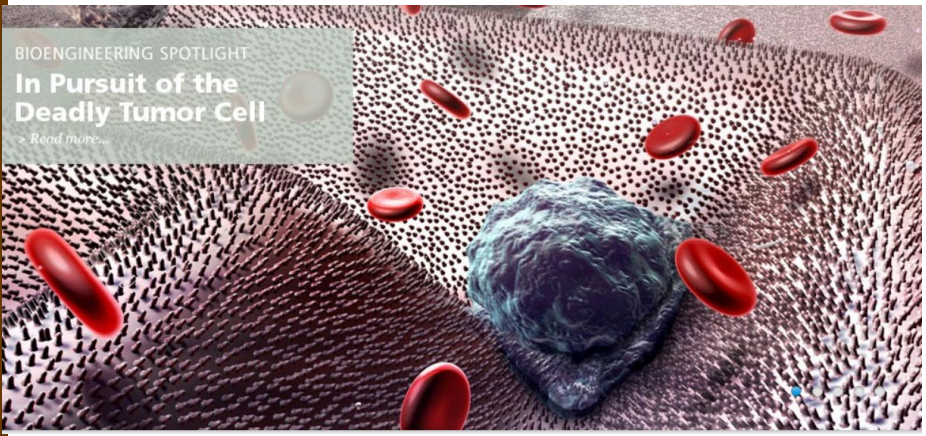
A WBC from MM-05

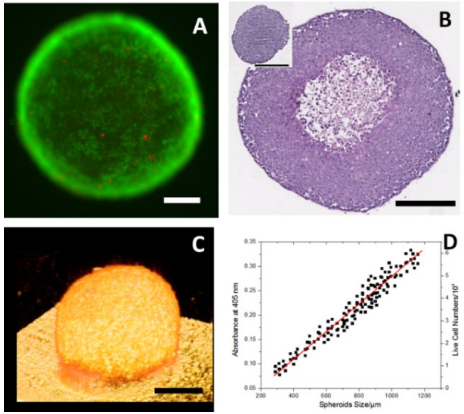


A CTC from RCC-06



Lab on Chip Capture of Circulating Tumor Cell from Patient Blood Sample



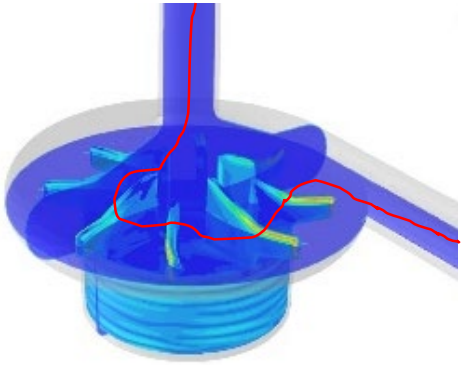


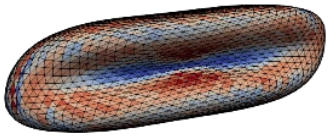
3D culturing of tumor spheroid for personalized drug testing

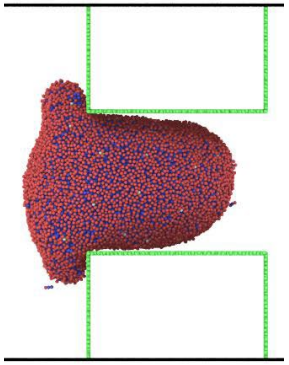
In collaboration with Lehigh Valley Hospital, we are using liquid biopsy (circulating tumor cell and circulating tumor DNA) for cancer diagnosis, monitoring, and personalized drug screening

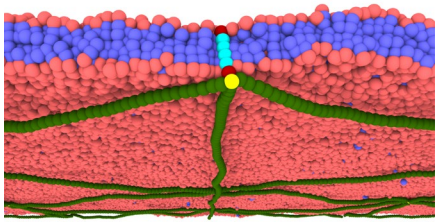
Hemolysis Prediction in Medical Devices

Multiscale modeling of blood cell damage in medical device









Hemolysis evaluation is an important step for FDA approval of any blood-wetting device. In collaboration with University of Maryland Medical School, we aim to develop a cellular model that can predict hemolysis in any device.

Contact

- Looking for PhD student and Post Doc
- Our research is supported by
  - National Institute of Health (NIH)
  - National Science Foundation (NSF)

- Contact: yal310@lehigh.edu