

MICRO-PHYSIOLOGICAL SYSTEM SEMINAR SERIES

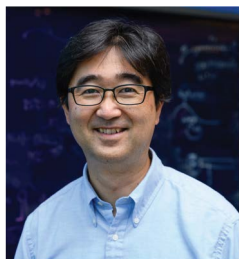
TUESDAY, SEPT. 17TH 11-12 LUNCH IS SERVED AFTER

KRONE EBB, 1ST FLOOR CHOA CONFERENCE ROOM



RSVP FOR LUNCH: [HTTPS://FORMS.GLE/DY3ND2XPFRQL5DMB](https://forms.gle/DY3ND2XPFRQL5DMB)

Speakers:



**Shuichi Takayama,
Ph.D.**

Professor, GRA Eminent Scholar, Price Gilbert, Jr. Chair in Regenerative Engineering and Medicine, The Wallace H Coulter Department of Biomedical Engineering, Georgia Tech & Emory



**Anna Liu,
Ph.D. candidate**

The Wallace H Coulter Department of Biomedical Engineering, Georgia Tech



**Jenni Li
Undergraduate
researcher**

Abstract:

» Microfluidics & International Research Collaborations --Shuichi Takayama

This seminars-plus-lunch program aims to catalyze scientific and cultural exchange between Georgia Tech students and 12 visiting undergrads from Japan. It will also provide GaTech students a brief preview of a planned international exchange program for summer 2020 and beyond. My presentation will start with description of an interesting microfluidic phenomenon and its application to microfluidic sperm sorting used for in vitro fertilization. This was an international industry-academia collaboration that led to an FDA-cleared medical device that is used clinically. The presentation will also describe a computer-controlled microfluidic pumping technology that was developed by an undergraduate student, then applied to biomedical needs such as microfluidic embryo culture, another device that has been tested clinically. A final microfluidic topic will be efforts, including work by GaTech Undergrads, to construct microscale intestine models with human intestinal organoids and a microbiome.

The presentation will also give a short preview of two components of the planned exchange program:

- (i) **Mentoring opportunity for GRADUATE STUDENTS to host a Japanese Undergrad Researcher for ~5 weeks in Aug/Sept 2020. Mentors will be invited to cultural exchange programs and also receive \$3000 to be used for travel to scientific conferences or materials and supplies for the lab.**
- (ii) **Another component is an opportunity for Georgia Tech BME UNDERGRADS to do a fully-sponsored Global Internship Program (GIP) in Japan in summer 2020 (mid May - July) doing research at leading Japanese Universities.**

» Ultrafast microfluidic cell compression for convective intracellular macromolecule delivery--Anna Liu

Efficient intracellular delivery of target macromolecules remains a major obstacle in cell engineering, cell labeling, and other biomedical applications. Our lab has discovered the unique cell biophysical phenomenon of convective intracellular macromolecule delivery using mechanically induced, transient cell volume exchange. Ultrafast microfluidic cell compressions are used to cause brief, deformation-induced cell volume loss followed by volume recovery through uptake of surrounding fluid. Macromolecules suspended in the surrounding fluid enter the cell on convective fluid currents. We harness this cell volume exchange behavior for high-throughput, convective intracellular delivery of large macromolecules, including plasmids (>10 kb) and particles (>30 nm), while maintaining high cell viability (>95%). Successful experiments in transfection and intracellular labeling demonstrate potential to overcome the most prohibitive challenges in intracellular delivery for cell engineering.

» Investigating health effects of aerosol particles on single-cells in a high-throughput air-liquid interface platform --Jenni Li

Air pollution and its detrimental health effects have been an increasingly alarming concern for the world. Cardiovascular diseases, chronic respiratory diseases, and different types of cancers can all be linked to air pollution effects. Furthermore, over 4 million people die per year from the direct effects of ambient particulate matter. One conventional method for studying the health effects of aerosol particles is to collect particulate matter (PM) from the atmosphere, resuspend the PM in cell culture media, add the PM/media to cell cultures, and assess single cell oxidative stress. However, this method does not resemble the in vivo conditions of alveolar macrophages. Alveolar macrophages are found in the alveoli of the lungs where the oxygen and carbon dioxide exchange between blood and air takes place and are a key cell type that is affected by PM. In this project, we aim to create a microfluidic air-liquid interface environment that mimics how alveolar macrophages are exposed to PM in order to study effects of PM at a single-cell level. Utilizing a microfluidic platform provides uniform microenvironment and enables high-throughput and high content single-cell analysis for hundreds of cells. We adapted a previously developed microfluidic single-cell analysis technology and developed a method for exposing cells to an air-liquid interface. We then characterized cells by microscopy and LIVE/DEAD staining to assess if cells remain viable during air exposure. Following this validation of the air-liquid interface platform, we will use it to study the single cell responses of intracellular reactive oxygen species in exposure to aerosol particles.