

MicroTAS 2021 Workshop 4 Information

WORKSHOP TITLE: Engineering Cellular Systems for Drug Discovery, Development and Exobiology

Note: Attendees may register for multiple workshops to obtain pre-recorded presentations by Oct 3 but will only be able to attend one live Q&A/discussion per time slot (1-4).

Pre-recorded presentation will be available by October 3 and panel will occur on: Sunday, 10 October, 11:00 - 12:00 Pacific Daylight Time (Palm Springs, CA), Sunday, 10 October, 19:00 - 20:0 British Summer Time (London), Monday, 11 October, 03:00 - 04:00 Japan Standard Time (Tokyo)

PRESENTER AFFILIATION:

Katherine Elvira, University of Victoria, Canada (<http://web.uvic.ca/~kelvira/>)
Victor M. Ugaz, Texas A&M University, USA
(<https://engineering.tamu.edu/chemical/profiles/vugaz.html>)

WORKSHOP DESCRIPTION:

Isolating the physical and chemical mechanisms that act together to promote the assembly of protocells is one of the major open questions in the origin of life. Hydrothermal microenvironments inherently embed favorable conditions to carry out these processes, but these systems are difficult to study because they involve micro-scale phenomena that are challenging to mimic synthetically. This workshop will describe microfluidic platforms for two related topics: (i) building lipid-based artificial cells and tissues, and (ii) towards the emerging area of exobiology that provides insight on the chemical and biological processes underlying life on Earth and elsewhere. Tips and tricks for the creation of artificial cells on a chip for drug discovery and development, as well as for advancing fundamental knowledge on synthetic biology and drug delivery will be provided.

OVERVIEW OF MATERIAL TO BE COVERED AND WHAT ATTENDEES CAN EXPECT TO TAKE AWAY FROM THE WORKSHOP:

(i) Engineering cellular systems (Katherine Elvira): Liposomes, droplet interface bilayers (DIBs), giant unilamellar vesicles, etc. are part of the long list describing the types of lipid-based artificial cells and tissues that can be built using microfluidic devices. In fact, in many cases, it is impossible to build these types of artificial biological entities without using microfluidic technologies. However, it is clear that we rely heavily on PDMS for device fabrication and that, especially for these fields, the surface characteristics of the device heavily impact the biological system. This workshop has three parts. Firstly, I will present an overview of the current state-of-the-art in the field for the formation of diverse types of lipid-based artificial cells and tissues. I will then give tips and tricks for their formation using different types of microfluidic devices. This will include the type of lab-based techniques that are hard to describe in a paper, but that can limit the formation of these artificial cells and tissues to experienced laboratories. Join me at the live panel to ask questions about any of these topics, as well as areas

such as reliable surface treatment methodologies for both aqueous and oil outer phases, the behaviour of lipid molecules on a chip, design flaws and triumphs to support these systems on a chip, and the use of materials that are not PDMS for chip fabrication.

(ii) Engineering systems for exobiology (Victor Ugaz): This workshop will guide attendees through familiar microfluidic methods that are already being successfully applied toward synthetic biology studies, but can be leveraged in new ways to synthesize vital building blocks of artificial cells under exobiological conditions. Specific topics include:

- Transport phenomena conducive to exobiological processes (thermally driven flows, 3D structure, chaotic advection).
- Bulk versus localized/surface processes.
- Applications toward protocell formation.

The discussion session will provide opportunities to answer questions and discuss future directions.

WHO SHOULD ATTEND:

This workshop is designed for both early-career and more established researchers interested in learning about new avenues to apply microfluidic tools in the areas of engineering artificial cellular systems for drug development and exobiology, including the origin of life. We will start with an overview of the current state-of-the-art in the field of lipid-based artificial cell and tissue research that should benefit early-stage researchers who want to understand what they are, and how they can be used for drug discovery and development. The field is relatively new, and therefore the live component of this workshop will also provide an opportunity for researchers with more experience to trade tips and tricks for the formation of different types of lipid-based artificial cells and tissues on a chip.

PARTICIPANTS WILL NEED THE FOLLOWING:

For those attending in-person, a laptop or iPad with headphones are required.