

PhD Position: Microfluidics Lab, IISER Tirupati

Droplet Microfluidics: Exploring Single Cell Secretion

What is microfluidics?

When vacuum tubes were replaced by transistors and integrated circuits huge electronics devices got confined into tiny chips, dramatically reducing size and increasing efficiency. An analogous trend is observed in bio- and chemical engineering: analyses and syntheses involving fluids, which originally could be done only on large scales, can be performed in microscale thanks to the developments in the field, microfluidics. *Microfluidic devices* or so called *lab-on-a-chip* devices carry liquids typically in volumes of micro- or nano-litres through microchannels or as tiny droplets.

Due to the enhanced effects of some physical parameters in this scale, microfluidic technology offers higher accuracy and efficiency to processes compared to those in the bulk scale. The research in Microfluidics involves the physics underlying in it and applications in interdisciplinary fields such as diagnostics, biomedical and chemical engineering.

PhD Position

We would like to study secretion of single cells, which can provide important information to biologists and cancer therapists. We will perform it merging Physics, Engineering and some Biology. Thus, this project will be in collaboration with bio-faculties and is a great opportunity if you are interested in interdisciplinary areas of research.

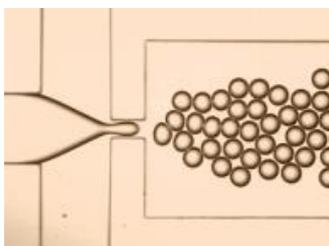


Figure 1: Micro-droplets in a microfluidic devices. Each droplet is 50 micrometer in diameter. In this project we will insert single cells inside in each droplet.

The project involves fabrication of microfluidic devices (lithography), creating micro-droplets in such devices and optimizing it. This part involves lots of physics and experimental skills. The second stage involves encapsulating individual cells into individual droplets and exploring them using protein assays. This part involves aspects of biology and will be in collaboration with bio-department.

Requirements:

- 1) General criteria as mentioned in the formal ad in IISER Tirupati website.
- 2) Someone interested in experiments
- 3) Student should be interested in interdisciplinary area (physics and learning some biology)
- 4) Previous experience with biology is not mandatory. But experience with basic courses in Physics is important.

References:

- (1) D. Mampallil, S. D. George, **Microfluidics — a lab in your palm**, *Resonance* 17, 682-690, (2012).

- (2) Todd M. Squires and Stephen R. Quake, **Microfluidics: Fluid physics at the nanoliter scale**, *Rev. Mod. Phys.* 77, 977.
- (3) Deng et al., **An Integrated Microfluidic Chip System for Single-Cell Secretion Profiling of Rare Circulating Tumor Cells**, *Scientific Reports* 4, Article number: 7499 (2014)

Please contact for more details or research papers referred above.

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