

Microfluidics, which is a technology to manipulate small volume of liquid ( $< 10^{-8}$  L) using micrometer scale channels, has attracted a lot of attentions for its biological applications. One major research direction is to fabricate so-called lab-on-a-chip devices to overcome the stringencies associated with biological analysis, such as the small amount of biological sample, the high cost of reagent, and the tendency of sample contamination. Another direction is to utilize the new capabilities (e.g., temporally/spatially stable complex gradient, and subcellular localized distribution) provided by microfluidic system for fundamental biological studies.

I am currently working on two PDMS-based microfluidic systems for biological applications. One project is to build a unique base-triggered reagent releasing device exploiting specific materials properties of PDMS. The electrochemical oxygen reduction reaction is used to produce an  $\text{OH}^-$  flux that triggers and actuates the release of biological reagents, such as DNA and small drug molecule. This releasing mechanism is particularly suitable for portable or embeddable devices because it requires a very low voltage ( $< 1$  V) and generates active reagent (e.g.,  $\text{OH}^-$ ) from oxygen. Another project is aimed to provide a novel microfluidic platform for cell studies. In contrast to other in-plane microfluidic systems (e.g, cells are inside the microfluidic channel), microfluidic channels in our system are located underneath cells by separating them with a permeable membrane. Biologically active reagent in the underling channel could diffuse through the membrane and reach the cells in a non-invasive way. This underground microfluidic platform leaves the above ground area open to facilitate cell culturing and surface modification.