Single organelle size sorting by a nanofluidic device

Microfluidic and nanofluidic devices for trapping and manipulation of nanoparticles and biomolecules have become a field of intense research. In particular, such devices enable lab-on-a-chip systems providing the ability to elucidate the nanoscale phenomena and single molecule studies, thereby paving the way for various applications in biology and chemistry. A nanoparticle sorter that is easy to use and gives a static picture of size distribution for accurate statistical analysis will be highly advantageous for many applications in biology, where such information is of great important to understand fundamental biomechanisms. For instance, cells tightly control the number and composition of intracellular organelles for their well-being, but the technical inability to track the molecular composition of individual organelles preventing us to understand this essential biological process related to tumor or other diseases. A striking example is the alteration of the size and number of mitochondria in neuronal cells suffering from neurodegeneration in Parkinson's disease.

In this project, the successful PhD student will develop a device and a method to quantify the number and size of mitochondrial organelles, to provide a direct diagnostic tool for Parkinson's disease. The project requires extensive use of micro and nanofabrication techniques in cleanroom environment. Size distribution and density of certain bioparticles are evaluated under an optical microscope. The quantitative data obtained will be correlated with molecular and physiological data relevant to various human diseases. The technology developed during this project can be used as a simple and high-throughput method for quantitative assessment of changes in cellular organelles, and thereby can be an effective method for understanding fundamental cellular processes and drug discovery.

This is a collaborative project bringing the complementary experiences of different groups in a unique way. The PhD student will be primarily located at PSI and will spend some time weekly in University of Basel in order to establish a strong collaboration.

We are looking for a PhD candidate who has a Masters level degree in science or engineering and has a keen interest in applied research in bionanofluidics. The candidate is expected to be a highly motivated team player and would like to pursue a PhD project with main focus on hands-on experimental techniques in nanofabrication, nanofluidics, and bioengineering. Relevant experience will be of advantage.

For further information please contact the project partners:

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