Centre DE Nanosciences & DE Nanotechnologies

C2N General Seminar

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Harnessing magnetic forces for microfluidic applications : some examples

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Microfluidics-based microdevices are now steadily making their way as a major tool in biomedical research. They yielded particularly impressive applications in massively parallel technologies, such as digital sequencing, or as a key (and often unrecognized) component of next generation sequencing machines.

The penetration of microfluidics in the field of diagnosis is also proposing great promises, but it raises new challenges, notably the need to purify and extract analytes from complex matrices.

In this talk, we shall discuss the challenges raised by this need, and propose some solutions and applications, based on the use of magnetic particles as a common denominator.

The first technology, named EPHESIA, is dedicated to the sorting and multimodal typing of rare cells. It consists in self-assembling in a high throughput microfluidic device, an array of antibody-bearing magnetic particles. We shall then describe a new approach allowing to downscale the fluidized bed principle, as an alternative to affinity chromatography in miniaturized format.

We shall finally show how magnetic particles can also improve the power of droplet microfluidics, and drive this technology out of its current mainstream families of applications, allowing in particular complex and programmable analytical processes.

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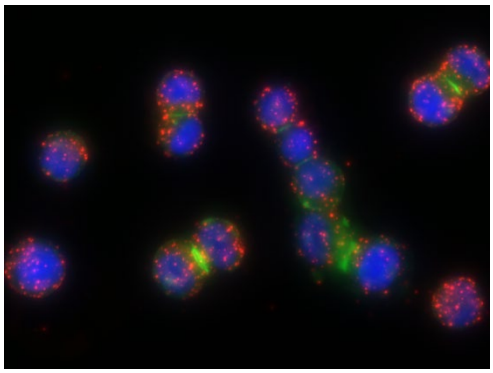

Labeled circulating tumor cells magnetically captured in microfluidics

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Jean-Louis. Viovy is Research Director Emeritus in UMR 168, (PhysicoChimie Curie), with multiple affiliations to Institut Curie, CNRS, PSL university and IPGG (Institut Pierre Gilles de Gennes for Microfluidics). He has been cofounder, with J. Prost and L. Leibler, of laboratory of theoretical chemical physics at ESPCI, and founded within the Institut Curie in 1996 the MMBM team (Macromolecules and Microsystems in Biology and Medicine) comprising about 25 researchers. In 2011, he co-founded IPGG with P. Tabeling. He was awarded the Bronze Medal of the CNRS (1983), the Polymer Prize of the French Chemical Society (1996), the Philip Morris Scientific Prize in 1996, two OSEO Entrepreneurship Awards in 2004 and 2005, and the Lifetime Achievement Award of American Electrophoresis Society in 2016. He is author or co-author of more than 300 articles and 30 patents. He was granted in 2013 an ERCadg funding on the topic of development of artificial organs. He was co-founder of the Chemical and Biological Microsystems Society, which organizes every year the MicroTAS conference. The beginning of his career was in polymer physics, and he switched in the 90's to biophysics, analytical sciences and microfluidics. He was co-founder of two startups, Fluigent and Inorevia. His current interests are mainly in methodological development in microfluidics, involving in particular the development of tools based on magnetism, organs-on-chips and textile microfluidics.