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Laboratoire PMMH
10 rue Vauquelin, 75231 Paris Cedex 05



Séminaire PMMH

Amphithéâtre Schutzenberger (A2), Escalier N, 1^{er} étage

Vendredi 11 mars 2016, 11h00-12h00

Lydéric Bocquet

LPS, ENS

Osmotic flows, from nanoscales to kidney filtration

Osmosis describes the flow of water across semipermeable membranes powered by the chemical free energy contained in salinity gradients. It is a fundamental transport process for water in all living systems, and its applications are countless. While osmosis can be expressed fundamentally in simple terms via the van't Hoff ideal gas formula for the osmotic pressure, it is a subtle phenomenon taking its roots in the interactions occurring at the scale of the membrane nanopores.

In this talk, I will discuss some molecular views of osmosis, which will be used in various contexts in order to harvest this powerful transport phenomenon. I will explore in particular the phenomenon of diffusio-osmosis, which is an interfacially driven transport phenomenon allowing for osmotic flow without the need of semi-permeable membranes. I will illustrate these concepts on the basis of various experiments using individual nanopores and nanotubes made of carbon and boron-nitride materials. Applications to osmotic energy harvesting will be highlighted.

Finally I will discuss the kidney filtration process. I will show in particular that the central piece of the kidney filtration, the U-shaped loop of Henle, is designed as an active osmotic exchanger. This counter-intuitive and efficient separation process is shown to operate at a remarkably small energy cost, typically one order of magnitude smaller than traditional sieving processes like nanofiltration. This suggests the design of a bio-inspired "kidney on a chip" mimicking the kidney filtration process.

Prochain séminaire : vendredi 18 mars, Romain Ricciotti (Agence Lamoureux & Ricciotti Ingénierie)

Programme des séminaires : www.pmmh.espci.fr, onglet *Séminaires PMMH*

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