Qualitative and quantitative on-chip analysis of circulating blood microparticles through combining SPRi and AFM approaches, and their functional studies on cells

Offer type : PhD project (Bourse MESR)
Salary : 1684.93 € gross wages
Application deadline : 31/05/2013
Institutional care : University of Franche Comté
Research lab : Institut FEMTO-ST, MN2S Department -UMR CNRS 6174- 32 Av. de l'Observatoire, 25044 Besançon Cedex, FRANCE
Collaboration : INSERM 1098, EFS, with head of lab : Pr. Philippe SAAS

FEMTO-ST (http://www.femto-st.fr/), a UFC-CNRS joint research unit (UMR6174), was founded in 2004 by merging 5 different laboratories active in different fields of engineering science: mechanics, optics and telecommunications, electronics, time-frequency, energetic and fluidics. Recently ranked A+ by AERES, FEMTO-ST features 700 employees (250 researchers, professors or assistant-professors, 150 engineers, technicians and administrtive staff and about 300 doctorate students).

Inside the "Micro - Nano Science & System" department (MN2S) of FEMTO-ST, the Multi Physics Microsystems team (MIMU) relevant to this project combines various skills in physics and engineering science to build full-featured microsystems with special emphasis on applications in biology and medicine. In particular, Wilfrid Boireau, team leader of MIMU and Céline Elie-Caille work at the interface of nanobio-engineering, microtechnologies and nanostructured materials for the development of new generation of sensors and analytical platforms in the fields of fundamental biology, diagnosis and clinical proteomic.

PhD project description:

Context :

The qualification and quantification of circulating blood microparticles (MPs) present a growing interest, especially in haemostasis and immunology fields. These micro- or nano-particles, measuring from 100 nm to 1 um, come from cell plasma membranes or intracellular organelles from all cellular types, and are physiologically present in plasma. These MPs convey real biological and/or pathological functions, could correspond to markers corresponding to certain therapeutic treatments and are sensed as potential biomarkers of human pathologies, in particular cardio-vascular diseases. It is of major interest to dose, characterize and evaluate the impact of these circulating blood microparticles on health.

The classical quantification mode relies on flow cytometry, but it is admitted that the majority of these MPs presents sizes below the detection limit of cytometry detection, that is 0.3 um. Their detection and characterization present a deep challenge that implies the development of new methodological approaches and instrumentations competitive at the nanoscale.

Research work :

Axis 1) Development of an analytic platform of microparticles: capturing, qualifying and dosing biological nano-objects in aqueous media of increasing complexity by combining approaches using SPRi and AFM on biochip

Axis 2) Functional study of microparticles on human dendritic cells : evaluate the impact of these micro- or nano-particles on cell biochips through combination of AFM and fluorescence imaging to understand the action mode of these objects on immunity target cells ; characterization of MPs cellular internalization ways.

Key words :

Nanobiosciences, Nanotechnology, SPRI, AFM, analytical platform, Blood microparticles

Applicant profile :

- Master student or engineer (preferentially diploma with distinction)
- **Skills :**
    - **Main:** Nanoscience, nanotechnology
    - **Secondary:** biochemistry, biophysics, cell biology,
- **English:** fluent
- **Aptitude :** motivated by innovation, challenging project, able to manage a multidisciplinary project

To whom application should be sent :

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Dr. Céline ELIE-CAILLE
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Required documents :

- A detailed application letter (2 pages max), précising general motivations to prepare a PhD and the particular motivations that lead to apply to this position.
- A detailed curriculum vitae
- The school report from the two last years (master studies or equivalent)
- Two recommendation letters (responsible of traineeship, of master studies, …)