INTERNSHIP PROPOSAL

Laboratory name: **Laboratoire Matière et Systèmes Complexes (MSC)**
CNRS identification code: **UMR 7057**
Internship director'surname: **Jean-François Berret**
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Internship location: **Université Paris Cité, Laboratoire MSC**

Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: EDPIF

Exploring Cellular Mechanics: nsights into Metastatic Breast Cancer Biomarkers

The Challenge: Cancer stands as a global health challenge, responsible for a staggering 25% of all deaths worldwide. Metastasis, the transformation of cancer cells into invasive agents capable of spreading and forming secondary tumors, remains a formidable barrier to defeating cancer. While treatments and therapies have made strides in addressing primary tumors, metastatic disease remains largely incurable, contributing to over 90% of cancer-related deaths.
Where Physics Meets Biology: In the last decade, a groundbreaking idea has emerged in biophysics: cancer cells possess a unique trait - they are softer than their healthy counterparts. This implies that the elasticity of cancer cells is lower than that of healthy cells. This characteristic is thought to enable metastatic cells to navigate through the tumor, infiltrate the bloodstream, and ultimately establish secondary tumors.
Our Mission: Our mission is to bridge the gap between biophysics and oncology by quantitatively assessing the invasive and metastatic potential of patient-derived cells. This information is crucial for diagnosing the aggressiveness of cancer.
The Challenge of Measurement: Measuring the mechanical properties of cells is no easy feat, especially when dealing with mammalian cells, which are micron-sized, with a volume on the order of one picoliter. How do we measure the viscosity and elasticity of living cells?
Our Innovation: We have pioneered the development of innovative micron-sized probes in the form of elongated wires. These magnetic wires, with diameters of 0.5 - 1 μm and lengths ranging from 1 - 10 μm, are created through bottom-up self-assembly synthesis. Our proof-of-concept studies on complex fluids and living cells have demonstrated the maturity and accuracy of this technology.
What You'll Work On: As an intern in our group, you will have the opportunity to delve into cell biomechanics and cancer research. We are focusing on human breast cancer epithelial cell lines exhibiting varying metastatic potentials. Additional work will be on genetically modified human breast cancer cells using CRISPR technology.
Your Mission: Your internship will center around testing and validating our biological model, aiming to establish a definitive correlation between cell biomechanics and cancer. This is an opportunity to contribute to cutting-edge research with real-world implications.
More information on the internship can be found here: https://www.jean-francois-berret-website-pro.fr/cell-biomechanics/

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO Soft Matter and Biological Physics: YES
Quantum Physics: NO Theoretical Physics: NO