

Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage / internship supervisor:	
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Nom du Laboratoire / laboratory name: Institut Lumière Matière	
Code d'identification : UMR5306	Organisme : CNRS/UCBL
Site Internet / web site: http://ilm.univ-lyon1.fr/	
Adresse / address: Université Lyon 1, campus de la Doua Bâtiment Brillouin 6 rue Ada Byron 69622 Villeurbanne Cedex	
Lieu du stage / internship place: iLM	

Titre du stage / internship title: Development of a multimodal microscope for quantitative imaging of encapsulated drug distribution in multicellular tumor spheroids

Résumé / summary

The vast majority of anti-cancer drugs that are injected intravenously are degraded by the body in a non-specific manner, and only a small fraction of the active substance reaches the tumor. For this, increased doses are used, in conjunction with other drugs aiming at weakening the immune system of the patient, causing unwanted adverse effects, and longer therapies. As an alternative, encapsulation of the active substance in nanocarriers improves the efficacy and specificity by targeting the tumor directly. However, such nanocarriers still have to cross physical and chemical barriers to homogeneously disperse in the tumor. Development of innovative therapies rely on the ability to simulate in vitro such barriers, and to develop instruments to quantify the distribution of nanocarriers within the tumor.

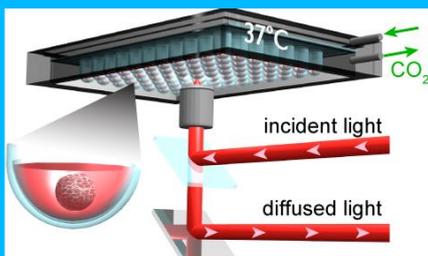


Fig. 1: Brillouin setup

providing essential information on the mechanics (rigidity and viscosity) of the sample. In collaboration with LAGEP, we have demonstrated the ability of our technique to monitor the real-time in-depth efficacy of nanoencapsulated drugs in tumor spheroids (Fig. 2).

The objective of the project is to further develop the instrument by coupling different microscopies (based on Brillouin and Raman spectroscopies and epifluorescent imaging), in order to map the distribution of nanocarriers within the tumor spheroid. By investigating the interaction of different spheroids that exhibit various physico-chemical barrier with nanocarriers, we will optimize the design of the nanocarriers to favour their penetration and efficacy. The PhD student will be in charge of developing the setup and fabricating the spheroids.

Local collaborative network : The student will work at ILM in the Biophysics and SOPRANO teams. She/he will be supervised by Thomas Dehoux and Jérémie Margueritat.

Spheroids are a powerful tumor model that accelerates the translation of novel therapeutics to the clinic. Formed from the controlled assembly of individual cells, they describe closely the complex tumour organisation and microenvironment, and can be designed to match the specificities of different types of cancer. However, their sophisticated structure challenges available imaging and testing modalities, and quantitative evaluation of drug efficacy in spheroids are sorely needed. At ILM we have recently developed a new type of microscope based on the scattering of light by hypersonic waves (Brillouin scattering). This unique instrument (Fig. 1)

enables a very high spectral resolution, whereby

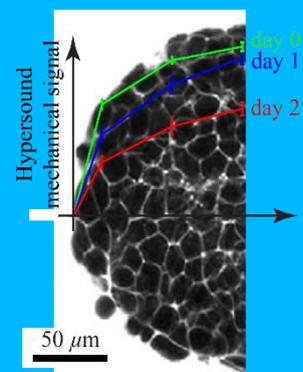


Fig. 2: evolution of the mechanical properties across a colorectal cancer spheroid during a 2-days drug therapy

The nanocarriers will be developed in collaboration with Giovanna Lollo from the team Pharmaceutical Engineering at the LAGEP.

Candidate background: The candidate will have a Master degree in Physics/Engineering. Skills in spectroscopy, optics or microscopy will be appreciated. Also, experience at the interface between physics and biology will be an advantage.

Keywords : spectroscopy, biophysics, biomedical optics, multicellular tumor spheroid

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : oui

Si oui, financement de thèse envisagé/ financial support for the PhD: ministère

Lumière, Matière, Interactions

Lasers, Optique, Matière

Fiche à transmettre (fichier pdf **obligatoirement**) sur le site <http://stages.master-omp.fr>