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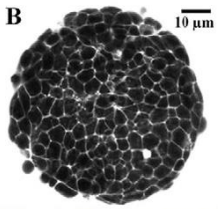
## Intership M2/PhD: Probing the elasticity of cancerous tumors with photoacoustics

The way mechanical properties arise from the elementary assembly of cells is a key mechanism for the formation of tissues and for the progression of degenerative diseases. For example, the higher deformability of tumors allows them to invade healthy tissues by transferring through the micro-environment. Understanding and tuning the mechanics of cell assemblies is therefore essential to control the progression of cancers. However, no existing modality can measure the elasticity of such objects, and the implementation of innovative means is required.

Acoustic waves are often used to probe complex systems such foams, granular materials of gels. They provide access to the mechanical properties (compressibility, shearing, viscosity) and allow implementation of non-ionizing imaging techniques that are not affected by diffusion in turbid media. The aim of this project is thus to **develop acoustic techniques to probe elementary assemblies of cells.** This approach will shed light on the link between mechanical properties, structure and biological functionality, thereby **offering innovating solutions for the understanding and control of tumors.**



*Tumeur modèle.*

In order to develop a platform that couples state-of-the-art optical microscopy techniques and ultrasonic techniques, it is necessary to manipulate acoustic waves without contact to the sample. For this, we will develop an inverted microscope based on the photoacoustic technique allowing **the generation and detection of acoustic waves with lasers**. We will also implement on this system a **device to compress the biological samples**. The analysis of the acoustic and compression measurements of model tumors developped in the Biophysics team (see figure) will demonstrate the link between mechanical properties and deformation of the tumor. The effect of various drugs on the mechanical properties of cancerous cell assemblies will then be tested.

**The internship will involve :** physics of waves, optical instrumentation for continuous and pulsed lasers, optical microscopy, preparing biological samples.

**Profile of the applicant :** a taste for interdisciplinary projects where physics meets biology. Project involving mostly experimental optics/mechanics. Possibility to develop analytical modeling of the experimental results.

**The project can be followed by a PhD.**

**More information :** website of the Biophysics team webpage of Thomas Dehoux.

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