What happened at the LBUM?

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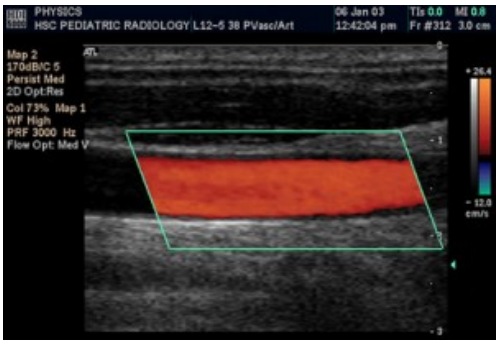
What to think about the visit of the laboratoire de rhéologie et d'ultrasonographie médicale (LBUM, http://www.lbum-crchum.com/) that took place last Wednesday? The first thing that comes to my mind is how nice these people were. For a full day, François Destrempes and a group of members of the LBUM interrupted their research to receive us and expose us the nature of their work.

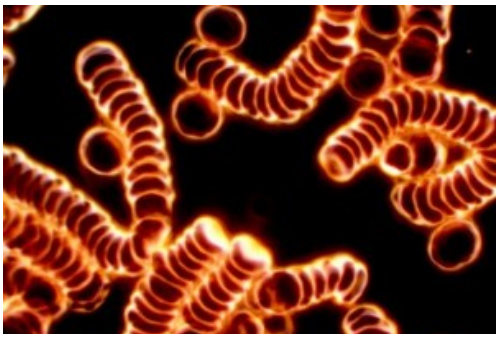
It all started in the morning with a word from the director, Dr. Guy Cloutier, who personally took the time to welcome us and inquire about our participants and the reasons that lead them there. Then, we moved on through a set of mazy hallways to land in the conference room, where we met Jonathan Porée, Étienne Mfoumou and Julien Tripette. In turns, each one of them presented an overview of their field of research.

To break the ice, Jonathan went over the technologies and techniques used in ultrasound imaging. Briefly, sound imaging permits a non-intrusive investigation of the tissues and fluids located inside the body. In B-mode, a linear array of transducer will listen to the echo resulting from differences in tissues density and compressibility, render possible due to the phenomena of backscattering of sound waves (similar to reflection in optic). The result is a two dimensional wave that spreads in depth inside the patient's body. For fluid imaging, techniques relying on the Doppler effect can be used, which gives an indication of the direction and speed of the fluid, travelling in a vein, for example.



Following him, Étienne explained us their novel approach to ultrasound imaging. While techniques such as B-mode works by relaying on the difference of density and compressibility to identify different tissues in the body, Étienne and his fellows work on an approach in which they generate a shear wave in the tissue and track it by listening to the radio-frequency echoes. What they observe with this technique is the variation in speed of propagation of the wave. The speed of a travelling wave is affected by the micro-elasticity of a tissue, which in turns informs us on its elasticity and viscosity. Why is that important, because knowing the biomechanical properties of a tissue gives us more information about the nature of the tissue and having an access to as much information as possible is crucial when comes the time of formulating a diagnostic.

Last talk of the morning, that was unfortunately cut short because of the animated discussion that took place during the previous presentations, was given by Julien. At this time we were becoming familiar with the concept of ultrasound imaging and Julien took us into a very practical example of what these technologies can be employed for. It is fairly common, and in fact normal, to see red blood cells (RBC) agglomerate together and take a shape similar to a stack of coins. What is not normal is when this stack of RBC becomes so big that it gets stuck in vessels leading to disease such as pulmonary embolism. Using the dynamic micro-elastography method, it is possible to characterise the viscosity of the blood clot and determine at which stage of development it is and help the treating physician recommend the appropriate treatment.



After a well deserved meal, we followed François to the laboratories of the LBUM. There, we were presented several ongoing projects. Samir Merouche opened the session by showing us his vein tracking robot. This robot makes use of ultrasound imaging to track a vein along its length to diagnose the presence of stenosis. Emmanuel Montagnon seconded him and explained how he is developing an algorithm, based on images generated by dynamic micro-elastography, to

detect the presence of breast cancer. Marzieh Alavi was the third student to present us her work. She is studying the propagation of various frequencies of shear waves in different kind of medium to build databases that will come useful in quantifying effects found in human body. Finally, our journey ended with Abderrahmane Ouared, who explained us that the United States Federal Drug Administration impose limits on the amount of energy that can be transported by an ultrasound beam, in order to guarantee the safety of the patient. His role is to develop a testing setup for the novel equipment developed by this lab.

To conclude, the visit of the LBUM put us in contact with a large field of research mainly centered around ultrasound imaging. We got a glance at what is going there and the challenges that these guys are facing. It was a time for us to relax and enjoy exchanging with colleagues of a foreign group. Overall, this day filled our expectations and we thank the LBUM for opening us their doors. We wish them good luck with their research and we hope to see shear waves derived sound imaging reach clinical applications very shortly.

The CAMBAM students team.

PS: Dr. Guy Cloutier indicated us that he was interested in receiving applications from students who wish to undergo a master or a doctoral degree in their lab. If you want more information or are interested in sending in an application, contact us and it will be our pleasure to put you in touch with the LBUM.