Research project proposal

"Micro-mechanics of the vocal-fold tissue: experimental in situ mechanical tests using synchrotron imaging"

Location : 3SR Lab, CoMHet team, Grenoble

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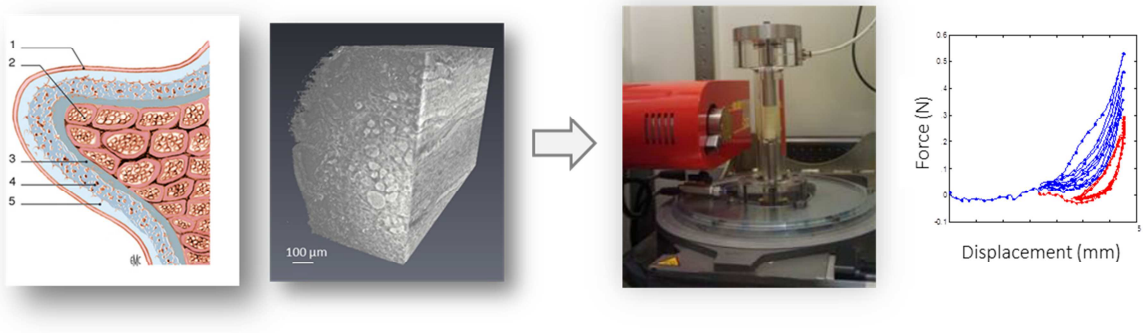

Figure 1: (left) Scheme of a 2D frontal view of the vocal-fold tissue and 3D imaging using ESRF imaging; (right) Illustration of the mechanical device used for combined 3D in situ X-ray imaging.

The vocal folds are soft multi-layered laryngeal tissues (Figure 1), owning remarkable vibro-mechanical performances. Composed of collagen and elastin microfibrils' networks, the upper layers play a major role in the vocal-fold vibrations. However, the impact of these tissues' histological features on their mechanical behavior is still poorly known. This is mainly ascribed to their challenging experimental characterization at the scale of their fibrous networks.

Within the ComHet team at 3SR laboratory, in collaboration with GIPSA-lab and LADAF laboratories (Grenoble), recent studies have shown the feasibility to characterize the multiscale architectures of excised human vocal-fold tissues using the European Synchrotron Radiation Facility (ESRF) X-ray microtomography. These prior works have allowed the 3D fibrous architecture of the muscular, collagen and elastin networks in the tissue to be revealed, albeit in static configurations.

The goal of this internship is to characterize the mechanical behaviour of human vocal folds' fibrous networks and their strain-induced microstructure evolutions during various uniaxial tensile loadings. An experimental campaign will be conducted using a tension/compression micro-mechanical device available at 3SR for 3D in situ X-ray imaging of fibrous materials (Figure 1), positioned on the ESRF's X-ray tomographs. Thereby, an original histo-mechanical database will be constituted and post-processed, to increase the knowledge on the specific vocal-fold micro-mechanics.

Applications - *Candidates with academic backgrounds in experimental solid mechanics, materials science and engineering are expected. Specific skills in microstructure analysis and/or biomechanics of soft tissues will be appreciated.*