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Morpho-mechanical study of 3D cellular assemblies with confocal Brillouin light scattering

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Morphological traits of 3D multicellular complexes can reliably discriminate features and gene functions[1]. Many ways exist for probing the morphology of 3D cellular complexes, with different degrees of spatial resolution and invasiveness. Brillouin Light Scattering[2] is in that matter a particularly interesting option because it is label-free and can perform measurements at a spatial resolution limited only by diffraction.
Here, we present a confocal device to perform Brillouin scattering images of 3D cellular complexes. By adjusting the degree of confocality[3] of our device, we show that it is possible to perform a reliable and non-invasive measurement of the morphology of an organoid at a spatial resolution where all the morphological information is kept, while ensuring the fastest acquisition rate. We also show that our approach is an improvement in terms of stability compared to state of the art setups.
We apply this technique to the identification of a particular kind of organoid, which is defined by its morphology: the acinus. Acini are hollow organoids which are commonly used as models of epithelial glands such as prostatic or pancreatic glands, and whose morphology is sensitive to the development of pathologies such as cancers[4]. Brillouin scattering being intrinsically a measure of the mechanical properties of an assembly, we conclude our demonstration by presenting a micromechanical study of the development of the cells composing an acinus during its morphogenesis, underlining the presence of an evolution of the mechanical properties of the cells.

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