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Towards a multimodal pipeline to characterize lung fibrosis: Phase-Contrast imaging and Porosity analysis

The gold standard for pathological tissue analysis is histology. Histology is a destructive technique and can provide only 2D information. To overcome these drawbacks a 3D imaging method such as computed micro tomography (microCT) can be used, providing a non destructive 3D view of the entire specimen.

Conventional microCT systems, based on benchtop microfocus X-ray generators, generally require the application of heavy metal based staining protocols to improve the image contrast. The use of a phase contrast approach can overcome this limit, providing a high quality volume rendering of unstained fixed samples.

In this work, we used phase contrast μCT to study unstained mouse lungs embedded in paraffin as a first step of a multimodal imaging pipeline including also IR spectroscopy, Atomic Force Microscopy and SAXS, and aiming to comprehensively characterize lung fibrosis.

To induce the pathology, an injection of bleomycin through the trachea of the mice was performed. This is the most common way to trigger fibrosis development.

Porosity analysis was performed in the reconstructed μCT slices in order to characterize the degree of fibrosis and to correlate it with pathological evaluation of consolidation, surface area and body volume. From these parameters we were able to distinguish between healthy and fibrotic model, and subsequently also recognize different degrees of fibrosis. Moreover, the μCT data allowed the identification of fibrotic regions and thereby to plan sectioning of the specimen for subsequent analysis.

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