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## Human lung virtual histology by multi-scale X-ray phase-contrast computed tomography

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Propagation-based X-ray phase-contrast tomography (XPCT) offers a unique potential to extend histology and pathohistology by a scalable, isotropic resolution without destructive slicing of the specimen and quantitative density-based contrast.

Here, we use virtual histology based on XPCT to image the human lung at synchrotron radiation endstations (P10, DESY) in different setups as well as by laboratory  $\mu$ CT instruments, and screen a broad range of sample preparation approaches. By comparing and optimizing setups and image parameters, we provide benchmarks of image quality and resolution on multiple scales down to the sub-cellular level. Using examples of several medically relevant pulmonary pathologies, we illustrate the advantages of obtaining three dimensional (3D) reconstructions rather than the two-dimensional images known from conventional histology. To complement manual evaluation of the data, we introduce quantitative morphometric parameters to characterize lung tissue and to compare between physiological and pathological states.

By optimizing imaging workflows and reconstruction routines, we can take advantage of the superior contrast and image quality provided by synchrotron radiation. Thus we can find a good compromise between resolution and field of view, providing ground truth for validation of laboratory data which is important for future standardization and translation of the method.

### Select Topic 1

Bioimaging

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Unmet Medical Needs

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