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Title: Generation of Acinar Skeletons after Synchrotron Radiation Based X-ray Tomographic Microscopy of the Lung Parenchyma

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Even subtle differences in the branching pattern of the acinar airways are crucial for airflow and particle deposition in the gas-exchange region of the lung. Skeletons of conduction airways have been generated using 3D-imaging methods. However the resolution of these methods was too low for the generation of skeletons of the gas-exchanging airways. To overcome this limitation we used synchrotron radiation based X-ray tomographic microscopy (SRXTM) at an isometric voxel length of 0.74 μm for high resolution 3D-imaging of heavy metal stained and paraffin embedded rat lung. Based on these images we developed routines to generate acinar skeletons. Segmentation of an acinus of interest was done after closing its terminal bronchioles followed by a region growing algorithm. The skeleton was extracted using a method based on a standard thinning technique combined with a distance transformation which ensures that the three dimensional topology of the resulting skeleton corresponds to the acinus extracted in the first step. Small holes in the alveolar septa - be it

Pores of Cohn or very thin areas of the septa which were segmented as holes - resulted in false connections not representing an airway. Using classical morphological criteria these holes were closed manually. Calculations were done using MeVisLab, a development environment for medical image processing and visualization. We conclude that SRXTM images are suitable for the generation of acinar skeletons and we would like to use this method for the analysis of the 3D-structure of the gas-exchanging airways.

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