HIGH-CONTRAST 3D IMAGING BIOLOGICAL TISSUES: EMBRYOS

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ABSTRACT

Understanding developmental processes requires accurate visualisation and parameterisation of three-dimensional embryos. There exist a few methods for non-destructive whole-volume imaging of animal tissues. X-ray microtomography (microCT) has the potential to produce quantitative 3D images of small biological samples. The microCT imaging has been limited by the low inherent contrast of non-mineralized tissues. Although X-ray contrast enhancement agents are used routinely in clinical radiography, only a few techniques have appeared for imaging soft tissues in preserved animal specimens.

We present high-contrast imaging of embryonic tissues at histological resolutions using a commercial high-resolution lab-based microCT system. This is demonstrated on 14 day mouse embryo stained by phosphotungstic acid which produce overall contrast and differential tissue contrast. Using the staining method the microCT imaging is established as a useful tool for comparative developmental studies, embryo phenotyping, and quantitative studies of morphology.

SUMMARY

The X-ray microtomography along with an appropriate soft tissue staining was established as a powerful imaging technique for ex vivo mouse embryos. The high-resolution (5 µm) allows very detailed visualisation of the inner structure.

We used PTA staining which produces overall contrast and differential tissue contrast for X-ray imaging. However this contrast agent doesn’t affect the cartilage tissue, which makes the following segmentation of this part more difficult. For the segmentation of those parts we used the Avizo which has an advanced tools for the manual segmentation. The staining procedure produce also a certain amount of shrinkage which has to be taken in an account in the quantitative studies of morphology.

BIBLIOGRAPHY