MICRO COMPUTED TOMOGRAPHY IMAGING OF MOUSE EMBRYO

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CTLAB X-ray Computed Tomography

Introduction

The mouse (*Mus musculus*) is a suitable model for studying gene function and modeling human disease because of the high homology between mouse and human genome[1]. For the research of gene functions and regulations exist a variety of mutant strains of mice which displays wide range of pathological conditions. Since part of those mutations are involved in structural changes of inner organs and they are often embryonic lethal, there is a need for method which can precisely image small inner stuctures of mice embryos such as a shape of mesenchymal condensation, cartilage or muscles[2]. Visualization of ossification in early developmental stages or segmentation of inner organs and its placement in context of whole body is also beneficial for the research of morphological changes.

Classical methods for studying mouse embryo such as electron microscopy and light microscopy, which provides high resolution 2D data are not able to provide 3D model of developing embryo and both methods destroys the sample. Micro computed tomography (microCT) imaging is a suitable complementary method which can provide precise analysis and images of minute samples as it is demonstrated in this poster.

Fig. 1: 3D model of 17.5 days old mouse embryo

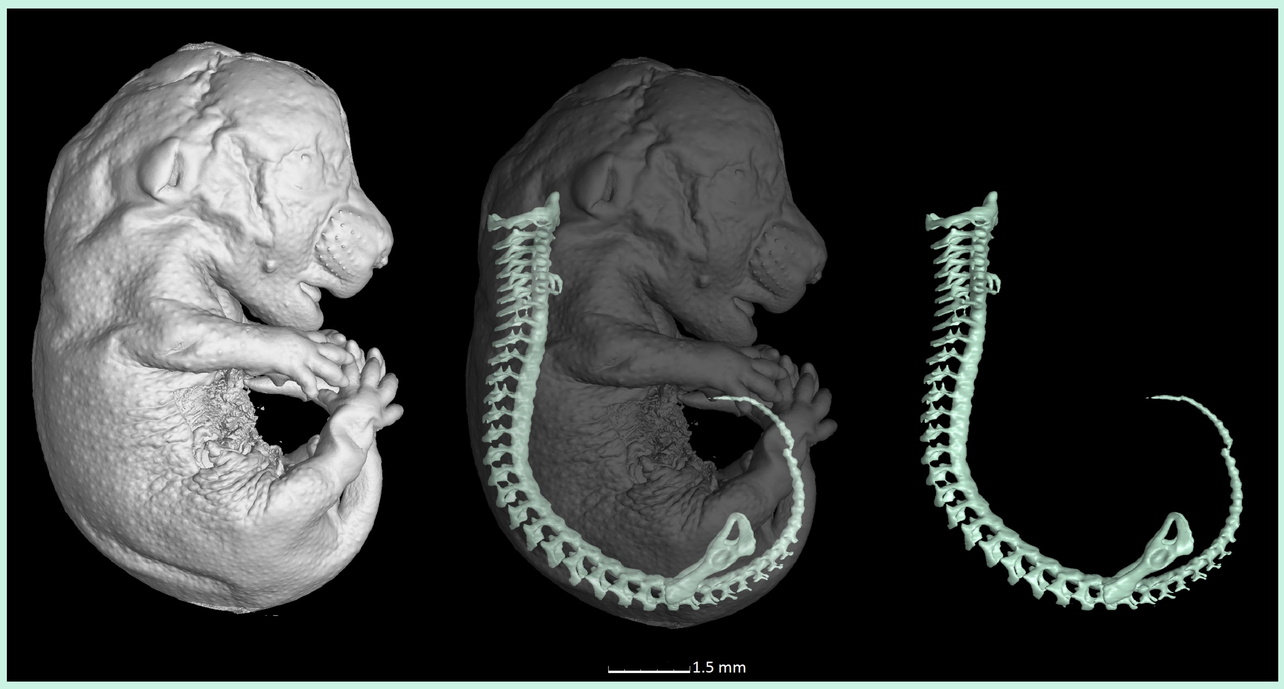

Fig. 2: Spine visualization in15.5 days old wildtype mouse embryo

Micro CT imaging

- Imaging of **spine** - manual segmentation allows overall comparison between wildtype and mutant phenotypes (see Fig. 2)
- Visualization of **heart** and surrounding blood vessels, Fig. 3 displays final 3D model and corresponding tomographic sections
- Fig. 4 depicts embryonal development of **nasal capsule**[4] from 12.5 days old embryo (yellow) to 17.5 days old embryo (dark blue)

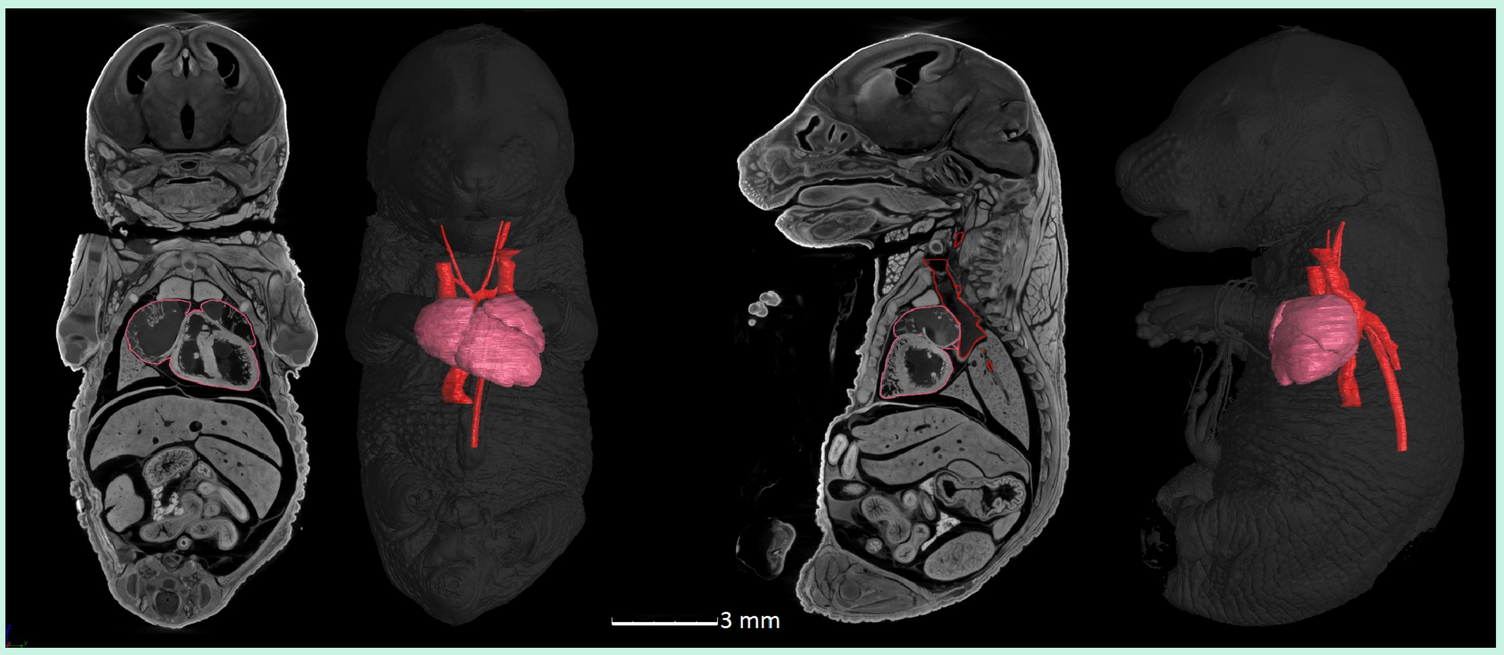

Fig. 3: Visualization of heart and surrounding blood vessels of mouse embryo

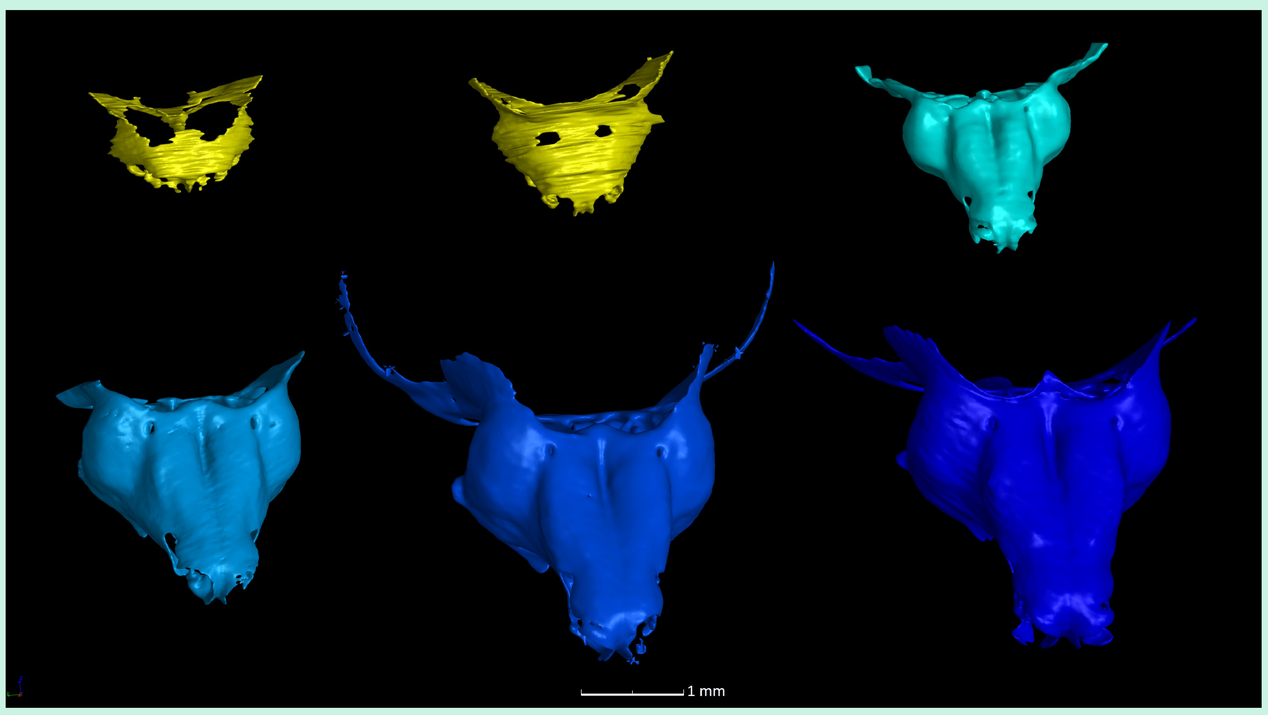

Fig. 4: Development of nasal capsule shape of mouse embryo

Materials and Methods

In this long term project various mutant and wildtype mice embryos (12.5 to 18.5 days old) were scanned.

X-ray based tomographic imaging is limited by the low X-ray absorption of embyonic soft tissues, and there is need to enhance contrast with staining[3]. MicroCT was used for mouse embryos imaging after staining by phosphotungstic acid which produce overall contrast and differential tissue contrast. The CT measurements were conducted using an industrial system GE phoenix v|tome|x L 240 equipped with an X-ray nanofocus tube. Manual segmentation and further measurement were conducted in VGStudio and Avizo software.

Summary

Widely used methods for studying mouse embryo are electron and light microscopy, which provides high resolution 2D data. But they are not able to provide precise 3D model of developing embryo and both of them destruct the sample. The method of micro computed tomography provides complex high resolution 3D images of small mice embryos, measurements of proportions and volumes, specific body structures can be segmented and analyzed and all of this while the sample stays intact and can be provided to further analysis by different methods.

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