Segmentation and analysis of notochord cells in 3D microscope data

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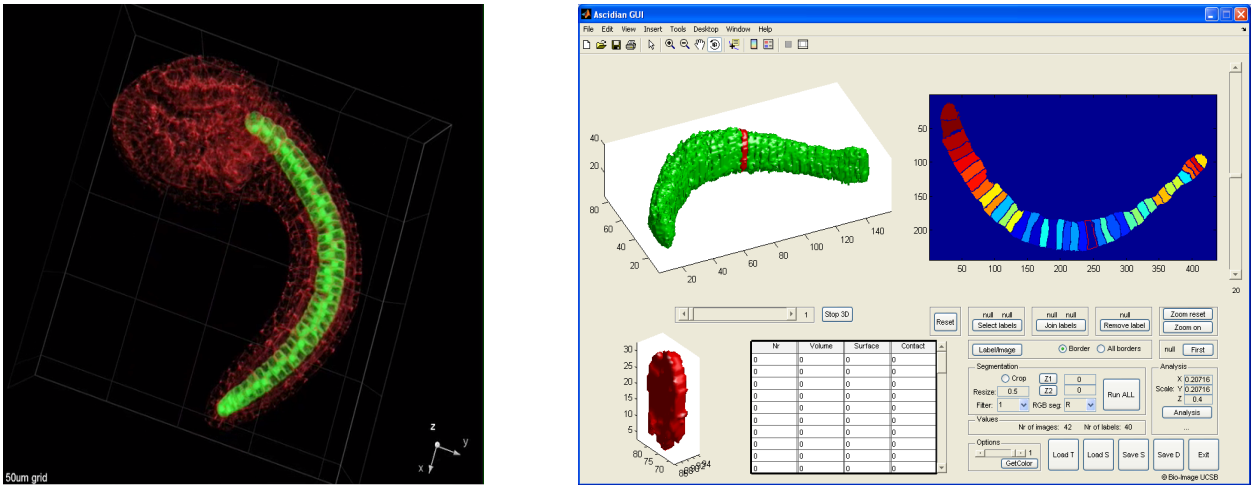
The notochord is an embryonic structure that undergoes dramatic cell shape changes as it itself changes shape from a roughly isodiametric primordium of mesenchymal cells to a long extended rod. Ascidians (sea squirts) have small, compact embryos with a notochord consisting of only 40 cells, allowing comprehensive 3D confocal imaging that would be challenging in other chordate model organisms (Fig. 1(a)). Here we show a semiautomated method for the 3D segmentation of individual notochord cells, and present our prelimary findings applying this method to a multi-gigabyte confocal image collection of phalloidin-stained ascidian embryos.

The proposed approach is based on mathematical morphology. The algorithm is able to reconstruct topological images and provide precise statistical data about the notochord cells (Fig. 1(b)). The proposed approach can be easily extended to any other tissues stained in a similar way.



(a) (b)

Fig. 1. (a) Single confocal section through an early tailbud stage ascidian embryo. Red: phalloidin staining labels cell peripheries. Green: notochord-specific Green Fluorescent Protein transgene. (b) *Ascidian 3D* - image analysis and processing tool.

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