Tyssue, an epithelium modeling library

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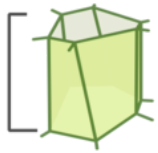
Montpellier, 25 September 2019



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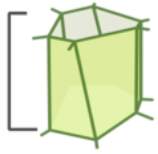
Understanding epithelium mechanics at the cell level



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Epithelial morphogenesis

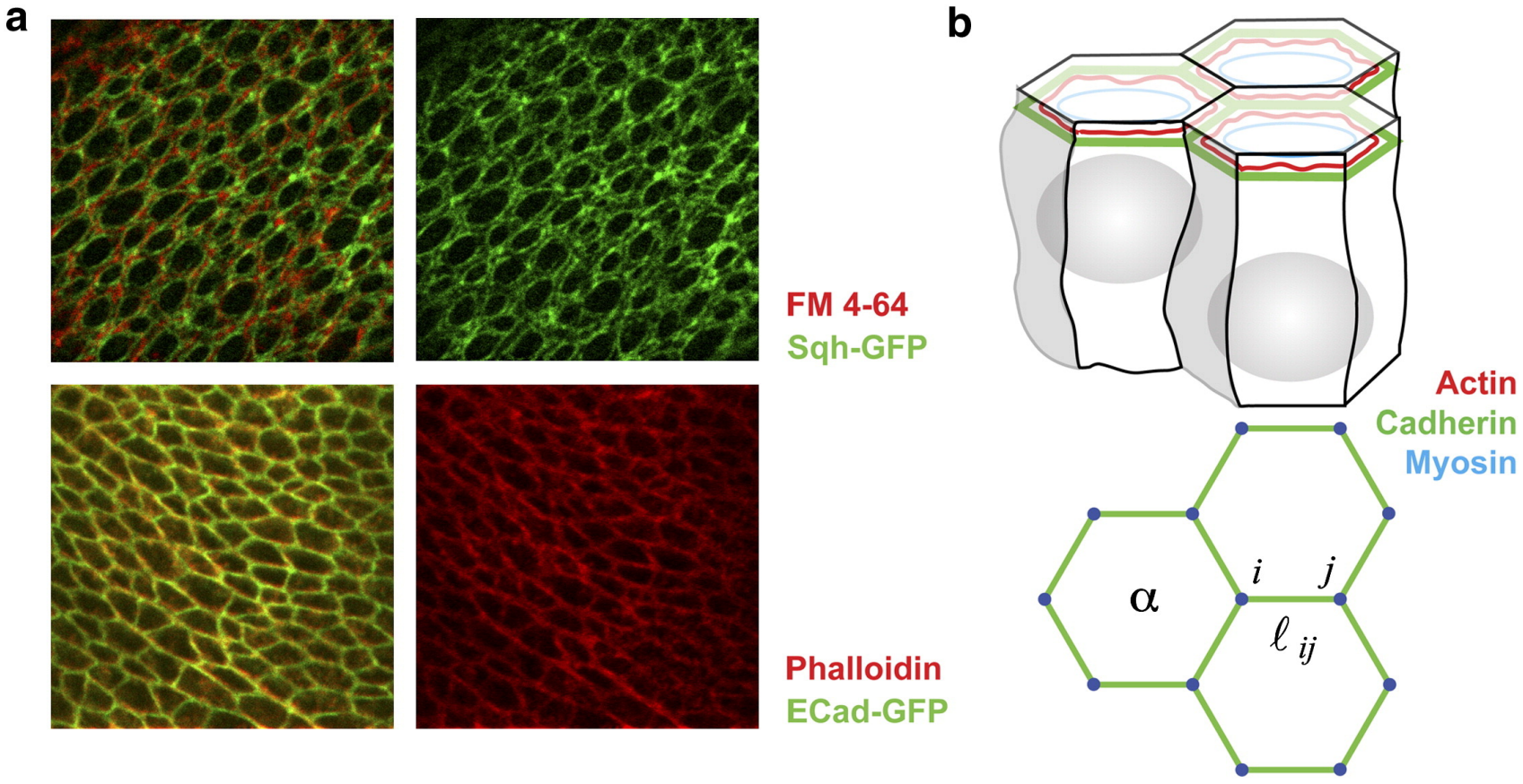

Figure 1: Farhadifar et al. 2007

Simple mechanics are often enough

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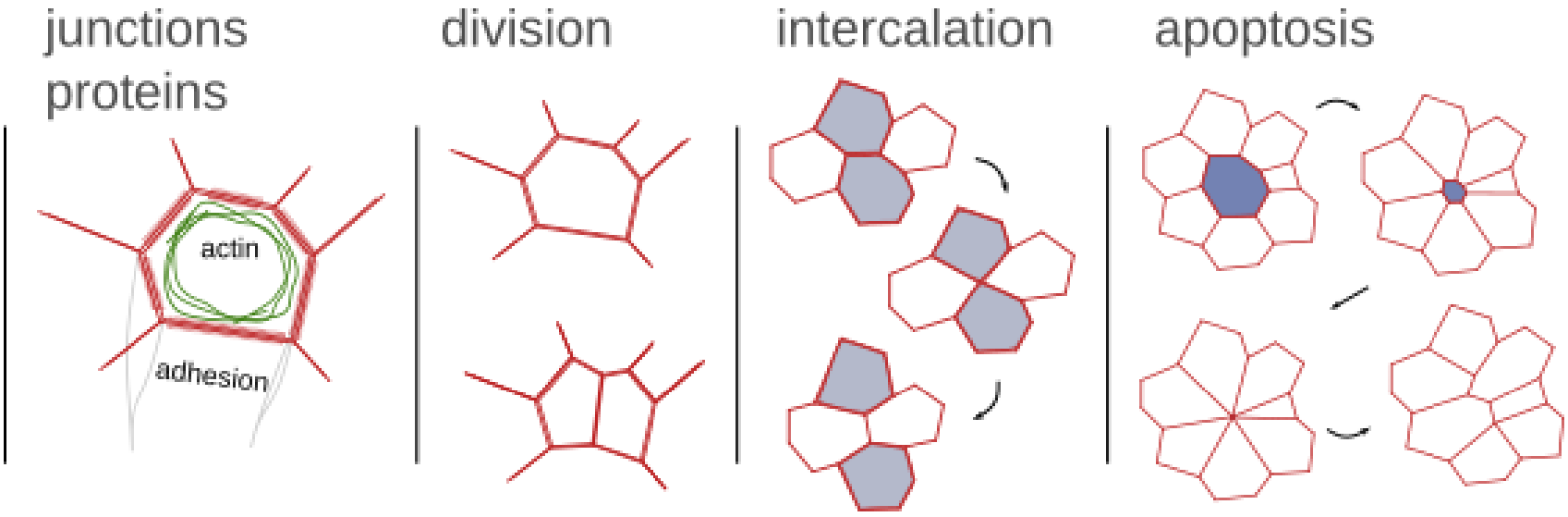
Role of apoptosis in fold formation



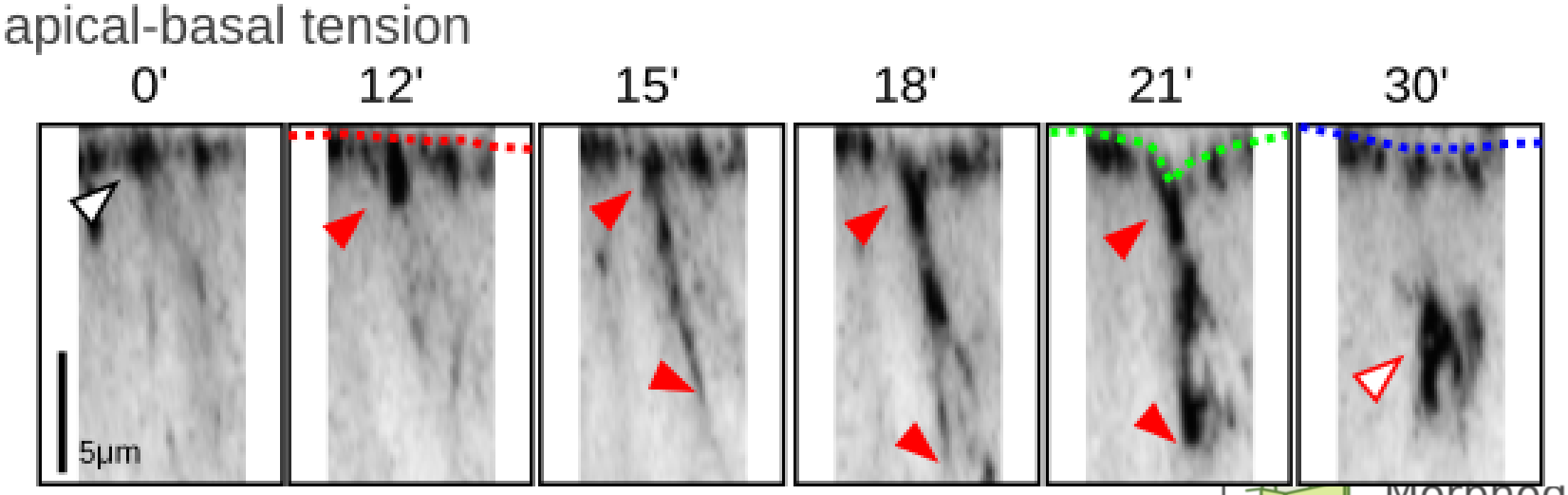


Figure 2: Gettings, Monier et al. 2015

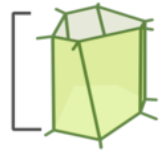
Role of apoptosis in fold formation

Without AB force or propagation

With AB force and propagation

Single cell processes interact with tissue level mechanisms

The `tyssue` library



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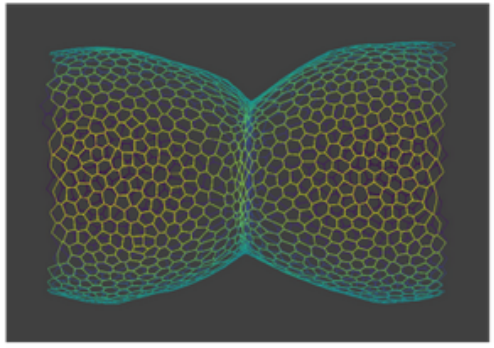
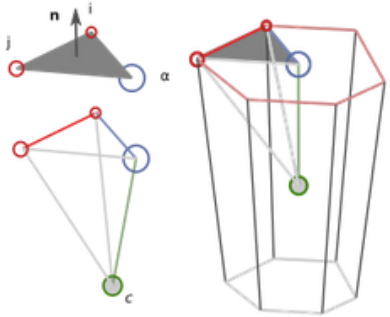
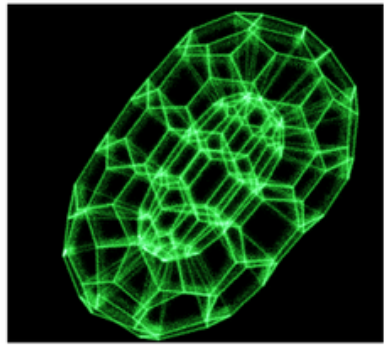
Design and architecture

Good practices

tyssue : An epithelium simulation library







build passing

coverage 80%

docs failing

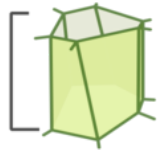
DOI 10.5281/zenodo.3351394 chat on gitter

The `tyssue` library seeks to provide a unified interface to implement bio-mechanical models of living tissues. It's main focus is on **vertex based epithelium models**.

Overview

Separate data, geometry and models

Design is essential to widen the range of applications



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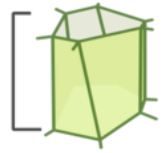
A gallery

- Fold formation
- Mesoderm invagination
- Rheology
- Organoid



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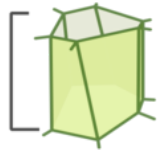
Open questions

- Pseudo stratified
- Role of the ECM?
- Mesenchymal cells
  Still work to do to capture a lot of biology



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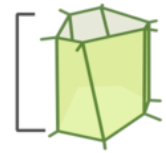
Force inference and model fitting



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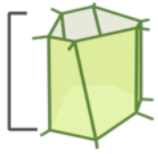
2D segementation

- Detection method
- Model reconstruction
  Pretty standard methods

Force inference and model fitting

- Method
- First results



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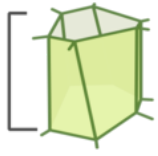
Perspectives

- Towards 3D



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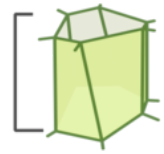
Tyssue



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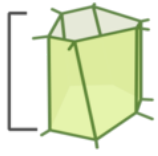
Tyssue

- Microscopy data to models
- Models as virtual experiments
- Models as parameter spaces



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