# Modelling self-organization in biological tissues: From agent-based to continuum models

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The mechanisms by which biological tissues self-organize over time are still largely unknown. In this talk, we use adipose tissue as a biological model and study the formation of lobule-like cell structures surrounded by an organized fiber network. We first introduce a 2D individual-based model for cells interacting with a complex network composed of fibers having the ability to cross-link or unlink eachother and to align with each other at the cross links. The model produces structures that compare quantitatively well to the experimental data, suggesting that cell clusters could spontaneously emerge as a result of simple mechanical interactions between cells and fibers.

In order to model the fibrous tissue at a large (macroscopic) scale, we then formally derive a macroscopic model for the fiber network from the microscopic model. The resulting macroscopic model consists of a system of nonlinear diffusion equations for the fiber density and mean orientation. Physical properties of the macroscopic fiber network are then deduced from numerical simulations. We finally present simulation results which show the good correspondence between the microscopic and the macroscopic models.