Cells, cell sheets and insect embryos: modelling the role of mechanics in tissue development

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It is becoming increasingly clear that mechanical interactions play a crucial role in controlling cellular behaviours in development and morphogenesis. However, it is often unclear how we can use these observations at the cell-level to understand the development of entire tissues. In particular inferring cellular behaviour from tissue-level experimental observations is complicated due to the multiple interactions and feedbacks that are dynamically occurring between cells and their microenvironments I will here demonstrate two different approaches. In the first, individual based simulations are used to tackle the problem from the bottom-up by postulating individual cell behaviours before 'growing' the tissue *in silico*. The second adopts a top-down approach using a continuum description of the whole tissue which is integrated with mechanical models for individual cellular behaviour. These models are used to explain cellular self-organization in the paradigm developmental system of *Drosophila melanogaster* and to infer individual cellular force generation from traction force assays.