IN-SILICO ORGANOGENESIS: IMAGE-DRIVEN MODELLING OF LIMB DEVELOPMENT

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ABSTRACT

Mesoscopic imaging techniques, such as optical projection tomography (OPT) and single plane illumination microsopy (SPIM), are becoming invaluable tools to understand multicellular development. Our lab has worked on both of these technologies, with a focus on obtaining new data sets to be used as the basis of dynamical computer simulations. Here I will describe our work to transform a classical model of developmental biology – the developing vertebrate limb bud – into a quantitative model system for image-driven multiscale modeling. In particular, we have developed: (a) 3D and 4D quantitative data-capture tools [1], and (b) new multiscale simulation software. This integrated approach is allowing us to combine two of the primary questions of organogenesis: mechanical morphogenesis (the active cellular movements which lead to shaping of the tissue [2,3]), and molecular patterning (the spatial regulatory networks which control gene expression – [3] and unpublished work).

REFERENCES

[1] Boot et al. (2008) Nature Methods 5(7):609-12

[2] Boehm et al. (2010) PLoS Biology 8(7):e1000420

[3] Marcon et al. (2011) PLoS Computational Biology 7(2):e1001071