Chemotactic cell movement a key mechanism of tissue dynamics and morphogenesis

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We investigate the molecular mechanisms by which cells produce and detect chemotactic signals and translate this information in directed coordinated movement up or down chemical gradients in the social amoebae *Dictyostelium discoideum,* and during gastrulation in the chick embryo.

During Dictyostelium development hundreds of thousands of cells aggregate chemotactically to form a fruiting body. Chemotactic cell migration during all stages of development is controlled by propagating waves of the chemo-attractant cAMP. Using a variety of imaging techniques we analyse the spatio-temporal dynamics of cAMP mediated cell-cell signalling and the resulting chemotactic cell movement responses to understand how the interactions between cell-cell signalling and movement govern the multi-cellular organisation of this organism. Investigation of mutants that change cAMP cell-cell signalling dynamics and the organisation and function of the actin-myosin cytoskeleton affecting chemotactic movement, show how cellular heterogeneity in signalling dynamics and polarised activation of the actin-myosin cytoskeleton drive aggregation, cell sorting, slug formation and migration. Hypotheses are tested by detailed model calculations.

Chemotactic cell movement also plays a critical role during gastrulation in the chick embryo. Our experiments show that epiblast cell movement during the formation of the primitive streak as well as the movement of the mesoderm cells after their ingression through the streak is controlled by a combination of attractive and repulsive guidance cues. We have identified FGF4 and VEGFA as attractive cues for mesoderm cells, while FGF8 and Wnt's act as repulsive signals. We are currently trying to establish how signalling and movement interact and use models to design experimentally testable hypotheses.