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Collective Chemotactic Cell Movement; a Key Mechanism of Development 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 movement up or down chemical gradients in the social amoebae *Dictyostelium discoideum,* and during gastrulation in the chick embryo. Investigation of Dictyostelium mutants with changes in cAMP cell-cell signalling dynamics and chemotaxis, show how cellular heterogeneity in signalling dynamics and polarised activation of the actin-myosin cytoskeleton drive aggregation, cell sorting, slug formation and migration. Chemotactic cell movement also plays a critical role during gastrulation in the chick embryo a model for amniote development. We suggest 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 use computer models explore signalling and cell movement interact to give rise to emergent phenomena at the tissue and organism level such as pattern formation and morphogenesis.