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MATHEMATICAL MODELING OF CELL-EXTRACELLULAR MATRIX INTERACTIONS TO EXPLAIN COLLECTIVE CELL BEHAVIOR AND CELL MIGRATION

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During embryonic development, the behavior of individual cells must be coordinated to create the large scale patterns and tissue movements that shape the whole embryo. Apart from chemical signals exchanged between cells, a prominent role is played by the extracellular matrix (ECM); these are the hard or jelly materials (e.g. collagens, fibronectin) that form the micro-environment of many cells in tissues. To get a better grip on the role of the extracellular matrix in determining the behavior of cells, we are developing mathematical and computational approaches to analyse the interactions off the mechanics of cells and the extracellular matrix (ECM) [1, 2, 3]. The cell models are usually based on the Cellular Potts model, whereas the ECM is model is based on a variety of approaches, including the finite-element model and molecular dynamics. I will show how these mathematical approaches help to elucidate the regulation of cell migration and collective cell behavior during angiogenesis and other mechanisms, including immune cell migration.

References

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