Chirotaxis: matrix chirality modulates the cell migration speed

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Chirality is ubiquitous in Nature, from living organisms to biomolecules, and influences fundamental processes that involve intermolecular interactions. Important biological processes are based on cell proliferation and migration, that both take place in interaction with the components of the extracellular matrix (ECM). Among them, collagen is the most abundant protein in ECM and connective tissues. Collagen consists of left-handed helical chains supercoiled into a right-handed triple helix. While various physico-chemical properties (e.g. stiffness, topography, confinement, etc.) of the cell microenvironment have been studied extensively, the influence of the ECM chirality on cellular migration has been overlooked. To address this issue, we used a microcontact printing technique to fabricate well-controlled culture surfaces coated with either collagen I as natural matrix or biomimetic matrices made of collagen-mimetic-peptides (CMPs) presenting opposite chirality (L vs. D peptides). The surfaces were characterized by circular dichroism, showing a specific polyproline type II helix (PPII) conformation of the chains. We show that D-surfaces prevent the total spreading of epithelial keratocytes which are less spread and more rounded, demonstrating that keratocytes are sensitive to the ECM chirality. Interestingly, our findings show that migrating cells on D-surfaces exhibit a lower migration speed than those on collagen I and L substrates but are significantly more persistent, suggesting that the molecular chirality of the ECM regulates key aspects of cell migration referred to as "chirotaxis". To better understand the role of the molecular chirality on cellular mechanotransduction pathways, we characterized focal adhesions and used specific inhibitors of collagen-binding integrin receptors during migration assays.





cell morphology?





Representation of a fish (*Hypsophrys*



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