

Three-Dimensional Characterization of Mechanical Interactions between Endothelial Cells and Extracellular Matrix during Angiogenic Sprouting

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We studied the three-dimensional cell-extracellular matrix interactions of endothelial cells that form multicellular structures called sprouts. We analyzed the data collected in-situ from angiogenic sprouting experiments and identified the differentiated interaction behavior exhibited by the tip and stalk cells. Moreover, our analysis of the tip cell lamellipodia revealed the diversity in their interaction behavior under certain conditions (e.g., when the heading of a sprout is switched approximately between the long-axis direction of two different lamellipodia). This study marks the first time that new characteristics of such interactions have been identified with shape changes in the sprouts and the associated rearrangements of collagen fibers. Clear illustrations of such changes are depicted in three-dimensional views.