

## Modulating Matrix Remodeling via Engineered Fibronectin Fragments

Mombeinipour M.1, Ek F.1, Rahikainen R.1, Turkki P.1\*, Hytönen V.1\*

The extracellular matrix (ECM) is a dynamic and multifaceted network that regulates cell behavior, tissue architecture, and mechanical signaling. Its remodeling—through synthesis, degradation, and reorganization—is essential for maintaining physiological function and adapting to environmental cues. Among ECM components, fibronectin (FN) plays a central role in matrix assembly and cell adhesion, primarily through interactions with integrins at its FNIII9-10 domain. These interactions are crucial for integrin clustering, force transmission, and structural organization of the matrix.

This study explores the use of a soluble, engineered SpyCatcher-FNIII9-10 fragment to modulate ECM remodeling. Mimicking the integrin-binding region of fibronectin, the fragment is designed to interfere with integrin clustering, potentially altering cell adhesion and matrix organization. To assess context-dependent effects, we examine its impact in two cell types with distinct ECM remodeling profiles, introducing the fragment at different time points to evaluate how timing and cellular context influence cell-matrix interactions.

Using ECM-coated surfaces, we investigate how cells respond to modified integrin engagement and clustering. This approach allows us to examine remodeling-related phenomena such as matrix reorganization and protein localization. In addition to visual observations, future work will incorporate quantitative analysis to better characterize the extent and nature of remodeling events. The study aims to clarify how integrin ligands with predefined oligomeric state can be used to dissect the molecular mechanisms underlying ECM regulation.

Insights from this work may support the development of new strategies for controlling ECM remodeling in both physiological and engineered environments and contribute to broader efforts in understanding cell-matrix communication.