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IISc uncovers link between cell biomechanics and wound healing

28 October 2023 | News

Wound healing occurs at different rates in different tissues due to Transforming Growth Factor-? activity

An interdisciplinary team of researchers from the Indian Institute of Science (IISc), Bengaluru has uncovered how the stiffness of a cell's microenvironment influences its form and function. The findings provide a better understanding of what happens to tissues during wound healing.

Inefficient wound healing results in tissue fibrosis, a process that can cause scar formation, and may even lead to conditions like cardiac arrest. Changes in the mechanical properties of tissues like stiffness also happen in diseases like cancer.

In this study, the team cultured fibroblast cells, the building blocks of our body's connective tissue, on a polymer substrate called PDMS with varying degrees of stiffness. They found that a change in the stiffness altered cell structure and function. Fibroblast cells are involved in extensive remodelling of the extracellular matrix (ECM) surrounding biological cells. The ECM, in turn, provides the mechanical tension that cells feel inside the body.

The team found that fibroblasts cultured on substrates that had lower stiffness were rounder and showed accompanying changes in the levels of cytoskeleton proteins such as actin and tubulin. Moreover, fibroblasts grown on such substrates showed cell cycle arrest, lower rates of cell growth and cell death.

To pinpoint the "master regulator" that drives changes in the cell when substrate stiffness changes, the team focused their attention on an important signalling protein called Transforming Growth Factor-? (TGF-?).

The researchers found that when substrate stiffness increased, TGF-? activity also increased, in other words, the levels of the active form of the protein started rising. This could explain why wound healing occurs at different rates in different tissues.