Mechanobiology, through the mechanical cues provided by cell-substratum and cell-cell contacts expressed in the form of shear stress, hydrostatic pressure, stiffness, or intercellular tugging, affects cellular proliferation, migration, and stem cell differentiation.

Microtopographies have been used to study, understand and recreate these cues:

- Studies have demonstrated that geometries of the microstructures on the substrate like pillars [2], wells [3], pits [4], pyramidal shapes [5], curved surfaces [6]; including height and width can influence cell alignment, their morphologies and polarities [7].
- Cell migration direction and velocity can be regulated by microscale topographies. Average migration speed is higher on microgrooved substrates than on flat surfaces [8,9,10,11]. In vitro, stiffness of the substrate can also guide cell migration (durotaxis) [12].
- Substrates with different patterns have provided physical stimulation for systematic differentiation of stem cells. In a study, neural stem cell (NSCs) cultured on chitosan films differentiated into astrocytes [13].

For neural tissue engineering, combination of uniquely designed micro grooves or pillars with molecules such as laminin [14] or nerve growth factors secreting astrocytes [15], or Schwan cells [16], have induced neurite alignment, extension, growth and differentiation. This research is particularly important for spinal cord injuries (SCIs) therapies to promote nerve regeneration. Multichannel conduits with seeded Schwann cells have promoted greater nerve regeneration and shortened the time for recovery in rats with transected spinal cord or sciatic nerves [17,18].

Engineered cardiac tissue have been able to recreate the anisotropy and mechanical properties of the myocardium; with an increase on cardiomyocytes systolic intracellular Ca^{2+} and slower diastolic rise in calcium [19].

In bone and cartilage tissue engineering, significant progresses have been made. Kirmizidis et al. [20], were able to align osteoblasts by varying the width of the grooves. Critical for cartilage repair, Moutos et al. [21], induced uniform spreading of chondrocytes with rounded morphologies.