Design and Fabrication of Microdevices for Cell Culture

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Transwells are devices that are placed inside a well of a multi-well plate to create a two chamber system. Cells are seeded into one chamber and a chemoattractant into another chamber in order to study phenomenon like chemotaxis and cell migration. But the currently available transwells for cell culture studies provide a flat 2D surface which fail to provide the cells the necessary biophysical cues for cell growth and differentiation. We addressed this problem by electrospinning as electrospun fibers share a morphology similar to that of the fibrous matrix that hosts the cells in the body. Inserts were made with the nanofibers for better cell growth and development and cells were further seeded. The SEM images revealed the presence of scarce amount of cells on the surface of the nanofibers. Leaking of media from the inserts was also a problem. This was fixed by the application of an adhesive like silicone and aluminum tape. The cell culture inserts being a static system wouldn't provide much of mechanical force required by the cells. Hence, we attempted to design a microfluidic device in parallel with the cell culture inserts. This microfluidic device employs the use of magnetic nanoparticles (iron oxide) in order to provide some mechanical actuation to the cells embedded in the nanofibers on the application of magnetic field while the cell response and drug discovery could also be studied alongside.

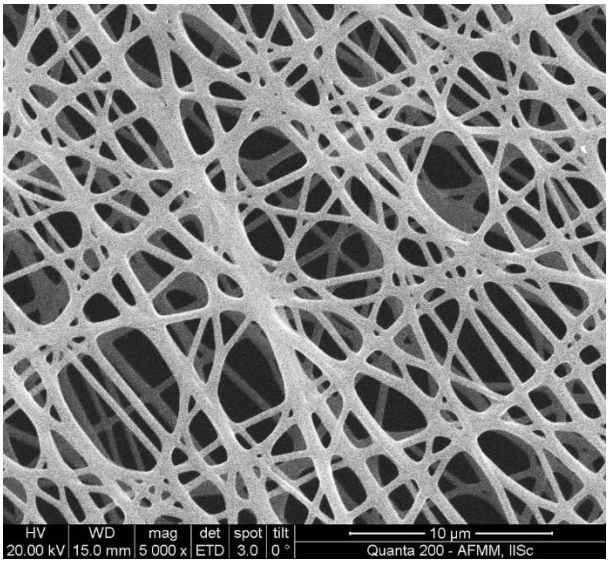

Figure 1. Scanning electron microscope image of electrospun nanofibers.