Droplet- Microfluidic Device for Stem Cell Culture

CNF Project Number: 2461-16
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Primary CNF Tools Used: Heidelberg DWL66FS/2000, SÜSS MJB4, SU-8 hotplates

Abstract:
We are working on a droplet-microfluidic device to generated microscopic beads of poly(ethylene glycol), a biomaterial we use to study the interaction between muscle stem cells and their environment. The device is made from PDMS cast on a SU-8 patterned wafer generated by standard SU-8 photolithography techniques at CNF.

Summary of Research:
Microfluidics have enabled a more high-throughput and comprehensive examination of biological systems. In particular, the interaction between stem cells and their local environment (the niche) can be studied using biomaterial constructs that attempt to recreate physical and biological aspects of the niche. We used a droplet-microfluidic device (designed and built at CNF) to generate hundreds of thousands of beads of the biomaterial poly(ethylene glycol) (PEG) with various physical and biochemical properties. We will be using these ~ 100 μm PEG beads as artificial microenvironments to screen for muscle stem-cell-niche interactions that are characteristic of muscle physiology. So far, we were able to create PEG beads with a different level of incorporated Laminin and observe myoblast binding in culture.

Figure 1: 100-micron PEG beads coated with the fluorescent (Alexa647) protein laminin (red / light grey). Clusters of myoblasts can be seen adhering to the beads.

Figure 2: Left: SU-8 wafer with patterned structures. Right: A series of eight PDMS microfluidic devices.

Figure 3: Droplet-microfluidic setup for generating PEG beads. Courtesy De Vlaminck lab.