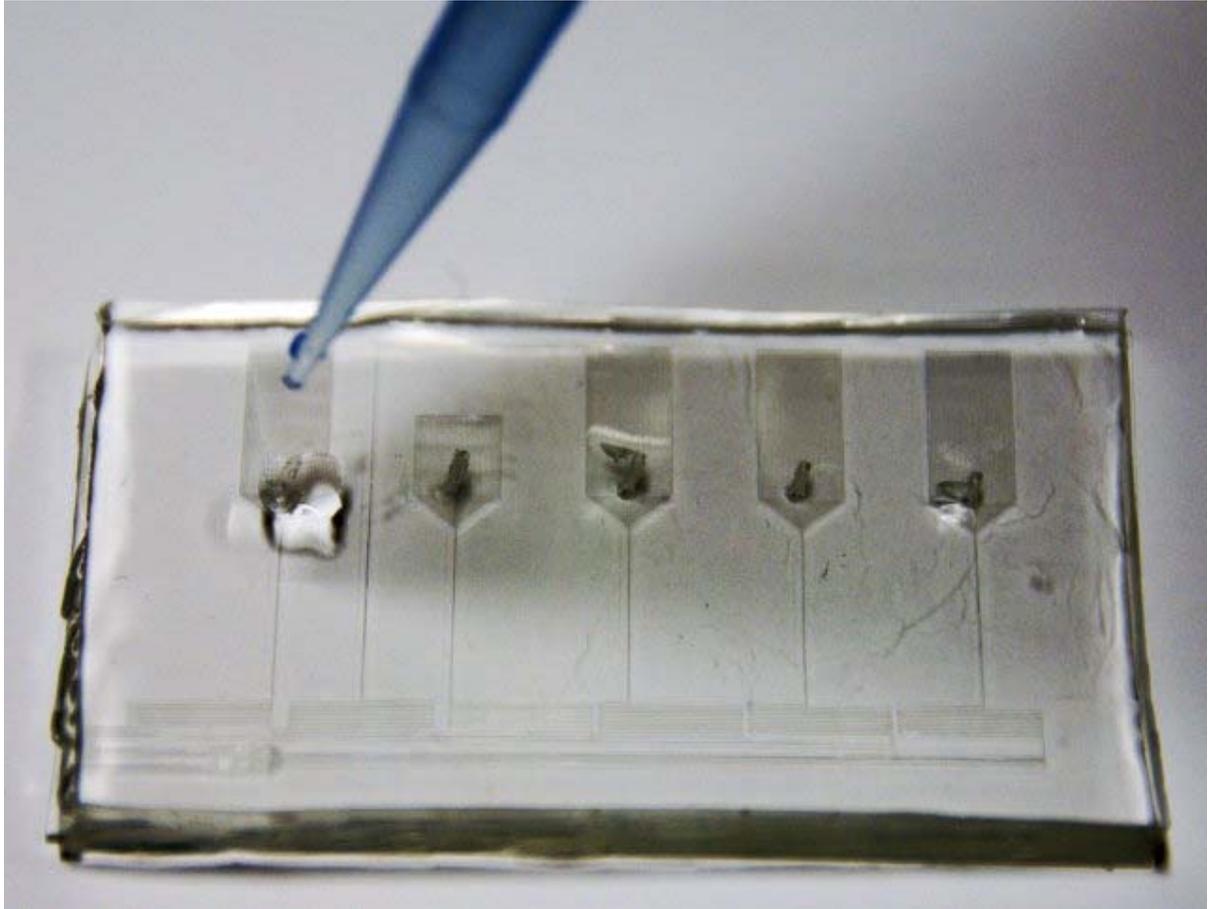


Filling Microfluidic Devices

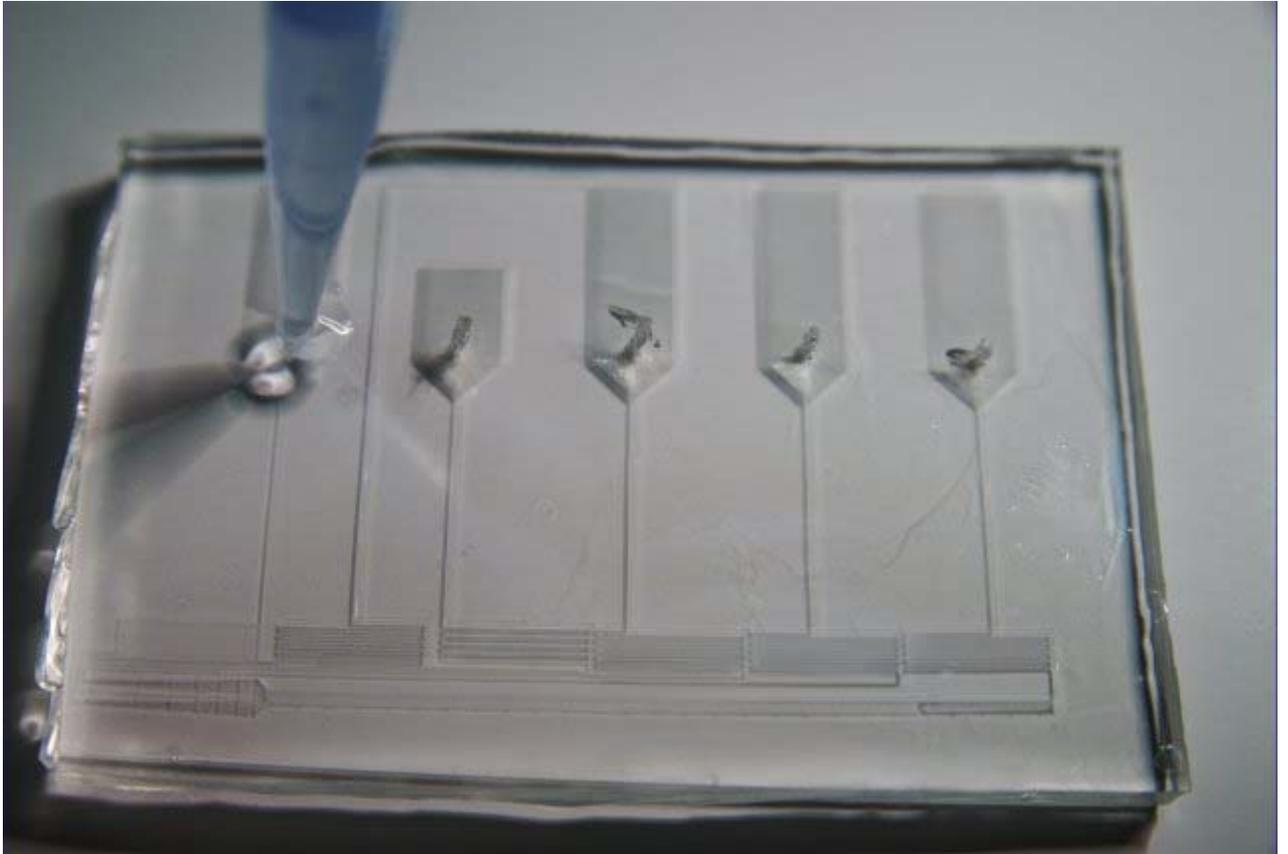
There's an art to filling microfluidic devices. It's easy to create air bubbles that limit or eliminate the functionality of the device. With a bit of care and some patience, though, it is possible to fill the devices fully with fluid. The process is to introduce fluid into one opening and allow capillary action to "suck" the fluid through the rest of the device. The device below has five connections; we are going to add fluid through the leftmost one.



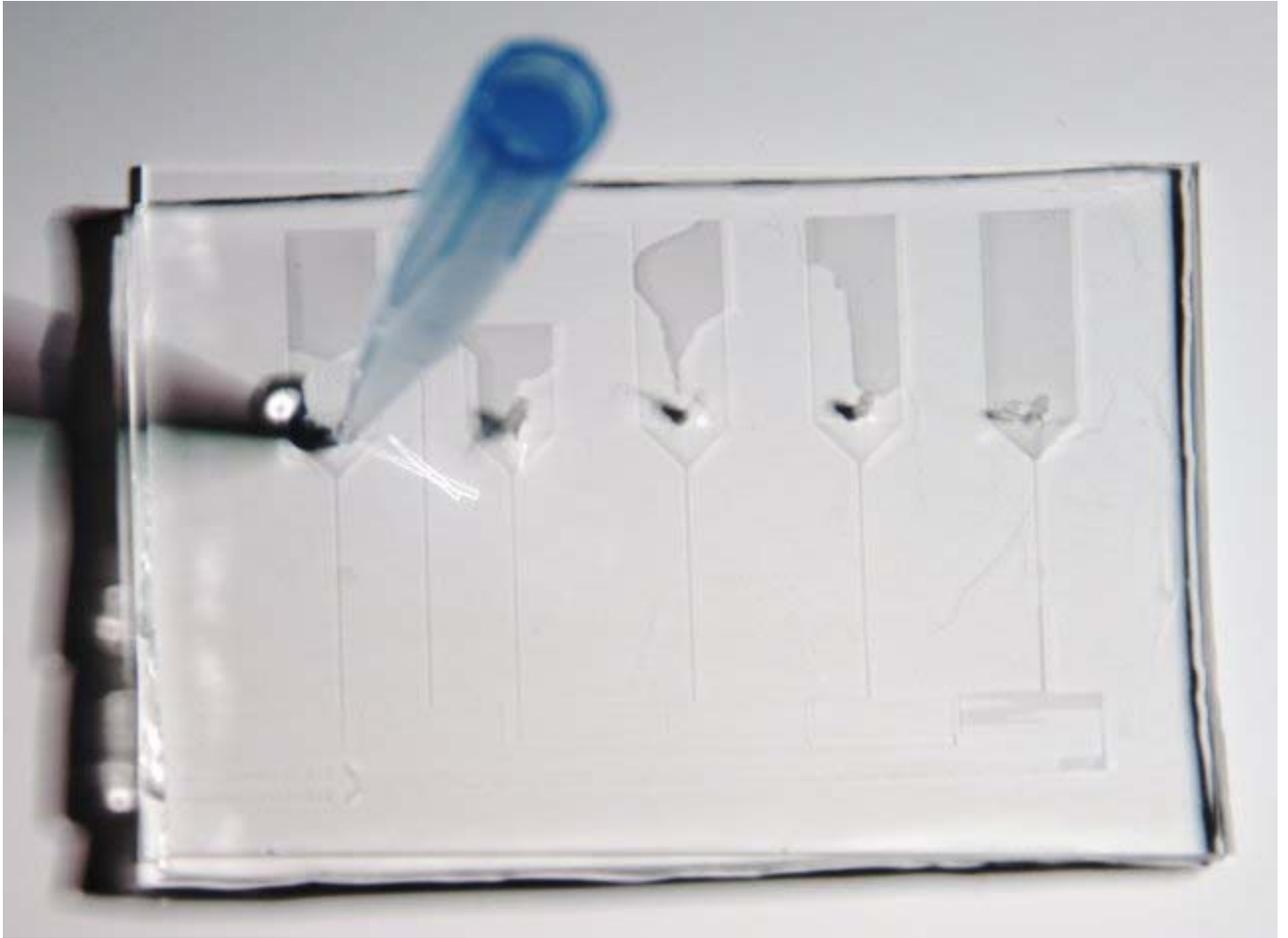
First, we place a small droplet of deionized (DI) water over the hole. This ensures that when we insert the fluid-filled pipette tip, we do not push air into the channel.



Next, we insert a pipette tip filled with DI water into the hole. Make sure that the pipette tip does not contain any air bubbles, particularly at the tip. In this photo, the device is already partially filled with fluid. Note the fluid boundary in the large channel near the lower-left corner of the device.



Finally, we wait until fluid fills the entire device. In the image below, fluid has reached four of the five openings. Once the fluid reaches an opening, it will start to form a water bubble above the hole. At this point, add some more water and insert a pipette filled with water. This will have two effects. First, it will guarantee that the opening will continue to be full of fluid. Second, if you fill the pipette the water pressure will keep more fluid from flowing out of that opening, helping the rest of the device to fill more quickly.



The device below is a battery-powered pipetter, which can be used to help fluid move through the device more quickly. However, it should be used **with great care**, since you can easily ruin a device with one of these. Applying positive pressure at the input containing fluid can help push the fluid through the device more quickly. However, the positive pressure can also break the bond between the PDMS and the glass, causing fluid to leak out of the device. In the process of making these images I did exactly that to the device shown, which is why there is no image of a completely filled device here. Applying negative pressure at one of the air-filled openings can also help bring fluid toward that opening. However, this can have the unintended effect of creating air bubbles elsewhere in the device (e.g., near the other openings). If you find it necessary to use this pipetter, be sure to check with an instructor, and use it only on the lowest setting.

