Nanoelectronics Undergraduate Research Fellowship (NURF)
2010 Project Summary

Student name: Mary Mahon
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Project title: Assembling microtubules in microchambers

There were several problems that occurred with every new piece of information that was discovered. First the problem was finding a way to seal the chambers. When that was fixed, the second problem was trying to find a way to prove that the dye was diffusing inside the chambers.

Microtubules assemble from the binding of α-tubulin and β-tubulin. In the cell microtubules are "dynamic", that is, they are constantly switching between polymerization and depolymerization. It is known that assembly and disassembly of microtubules follow complex kinetic behavior and are regulated by many proteins. These behaviors of microtubules are normally studied in environments that are much larger than an individual cell, however, there is reason to believe that the physical constraints caused by cell boundaries change microtubule behavior[1]. This project uses microfabricated chambers to provide an environment typical of a cell. Photolithography of SU-8, a negative photoresist, was used to create chambers ranging in size from 5 to 150 microns square, and a silicone elastomer film deposited on glass cover slips was used as a "ceiling" to lay over the top. This study focused on testing the effects of changing the cleaning and surface treatment of the chambers and ceiling. Strategies such as plasmas etching, PEGylation, and change in materials were utilized.

The main questions are how surface treatment controls:
1) Whether material could leak from a chamber
2) Whether proteins (tubulin or antibodies) stuck to the walls or ceiling of the chambers.
Photobleaching experiments were used to demonstrate the sealing of the ceiling.

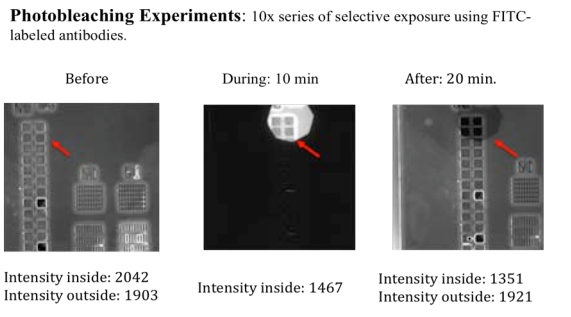
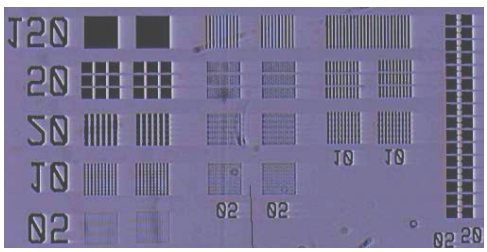


Figure 4-6: Chambers containing FITC-labeled antibodies were selectively bleached in order to determine if liquid from the surroundings was leaking back into the chambers. The arrow points to the bleached chambers. The intensity of the dye both inside and outside of the chambers stayed the same after the bleaching experiment. This clearly shows that the FITC bleached out over time with no leaks into or out of the chamber.

Figure 1. Mask used to create various sized microchambers. Reproduced via photolithography onto microscope coverslips for



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I will be presenting the poster “Attempts at sealing the ceiling of microchambers” at the Tri-University Symposium and at the MIND poster session.