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Surface Engineering for Microtubule Manipulation[1] JOHN NOEL, WINFRIED TEIZER, Dept. of Physics, Texas A&M Univ., WONMUK HWANG, Dept. of Biomedical Engineering, Texas A&M Univ. — Microtubule filaments act as dynamic structures inside cells for cargo transport and cell motility. We have used self-assembled monolayers and lithographic techniques to control surface interactions between microtubules and synthetic substrates. Switchable protein adsorption has been achieved using an electrode coated with a non-fouling polyethylene glycol self-assembled silane monolayer (SAM). Novel integration of the SAM into current electron-beam lithography techniques has allowed for the underlying electrode to be patterned with much freedom of geometry while preventing permanent adsorption of the protein. In this configuration, microtubules assemble on top of the patterned electrode but are blocked from the surrounding regions. The reversible adsorption permits study of microtubules under spatially controlled electric fields. Furthermore, such active test surfaces can be used to study microtubule assembly and to simulate kinesin motor transport in neurons. This method is also compatible with DNA and other biomolecules and, unlike soft lithography, can be scaled down to tens of nanometers in a straightforward manner.

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John Noel
Dept. of Physics, Texas A&M Univ.

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