

W0538

Nanotubular Structures of Microtubule-Spermine and Microtubule-Lipid Complexes. Y. Li, D.J. Needleman, U. Raviv, M.A. Ojeda-Lopez, H.P. Miller, L. Wilson, C.R. Safinya, Materials Research Laboratory, Materials Dept., Physics Dept., Dept. of Molecular, Cellular, and Developmental Biology, Biomolecular Science and Engineering Program, Univ. of California, Santa Barbara, CA 93106 USA.

Two distinct supramolecular assemblies of microtubules (MT) in the presence of spermine and cationic lipids membranes were revealed using small angle x-ray diffraction and electron microscopy. The MT-spermine complex is characterized as a columnar phase of inverted tubules, in which the orientation of the tubulin units was switched from inside out. The transformation of normal MT to the inverted tubules is induced by a novel phase transition driven by a discrete conformational change in the constituent tubulin subunit. In MT-membrane complexes, two new structures were observed. Depending on conditions, lipid vesicles either adsorb onto the microtubule, forming a 'beads on a rod' structure, or coat the microtubule to form a sheath. Tubulin rings can then coat the external lipid bilayer to form a multi-shell tubular structure with a tubulin-lipid-tubulin radial profile. Kinetic experiments were conducted to shed light on the mechanism of hierarchical complex formation. Research supported by NIH GM-59288, NSF DMR- 0503347, CTS-0404444.