199e A Study of Structure of Aplysia Californica Neuron Growth Cones Using Atomic Force and Epifluorescence Microscopy

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The atomic force microscope (AFM) has been used to study fixed Aplysia californica neurons to determine the nanometer scale structure and height of the domains of the growth cone. The lamellipodium was found to be a uniformly flat region with a height of 53 nm, the ruffling region was determined to be about 500 nm tall, and the central domain was about 1 μm tall. The filopodia tips were found to be taller than the filopodia bodies with heights of 96 and 38 nm, respectively, which could be associated with the sensing function of the filopodia. The AFM height information was compared with fluorescence labeled dextran epifluorescence images, which is a commonly used optical technique for the determination of the relative volume of cells. The fluorescence and AFM height images were qualitatively similar but line scans showed significant variations on the submicron scale. We attribute these differences to the actin and microtubule composition of the growth cone which influences amount of dextran in a volume element. Combining AFM and optical microscopy produces three-dimensional images with high spatial and temporal resolution which is useful for understanding the molecular mechanisms of growth cone dynamics.