488e Afm Characterization of the Stability and Structure of Collagen Membranes

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Atomic force microscopy (AFM) was used to predict the diffusional properties as well as the stability of adsorbed type I collagen. The collagen gel model for tissue culture has found increasing use for experiments involving drug discovery, toxicology, and tissue engineering. Although embedding cells within a 3-dimmensional matrix improves the sustainability of differentiated cellular functions for many cell types, previous work has shown that this also creates a substantial diffusional barrier to metabolites such as oxygen. One way to estimate this barrier is to use AFM to characterize the structure of adsorbed collagen. From images, parameters such as tortuosity, pore size distributions, and volume fractions were determined. For a gel prepared under typical conditions, the effective diffusion of oxygen was estimated to be 1.6 x 10-5 cm2/sec compared to empirically determined values of 1.5 ± 0.4 x 10-5 cm2/sec. In addition, the effect of refrigerated storage on collagen gels was explored. Upon one day of refrigeration, the void volume density of the gel decreases by 30%, indicating that the collagen gel undergoes reconstruction during storage. Since many cell types are sensitive to the structural cues received from extracellular matrices, this suggests care should be taken for analyzing data taken from collagen gels prepared on different days.