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Probing Aggrecan Interactions with Ions by AFM PREETHI CHANDRAN, EMILIOS DIMITRIADIS, PETER BASSER, FERENC HORKAY, National Institutes of Health — Aggrecan (MW ≅2 MDa) is a highly charged bottle-brush shape biological polymer found in the extracellular matrix of tissues. It consists of a protein backbone (≅400nm long), to which about 100 linear chains of negatively-charged glucosaminoglycans are attached approximately 4 nm apart. The high charge density of the aggrecan bottle-brush allows it to imbibe water, thereby maintaining tissue hydration and permeability, while also binding to cell-signaling molecules. In solution, aggrecan molecules respond differently to varying salt conditions, than other charged biological and synthetic polyelectrolytes like DNA and poly(acrylic acid) (Horkay, 2008). To probe the nature of its interactions with charged surfaces, we looked at the absorption patterns of aggrecan assemblies on controlled surfaces (polylysine, mica) under different ionic conditions, using Atomic Force Microscopy. We propose a simple model of the charge interactions, which relates the surface-adsorption patterns to the solution structures. The study may help understanding how aggrecan loss or degradation with age and joint disease affects tissue microstructure and physical properties.

Preethi Chandran
National Institutes of Health

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