ATOMIC FORCE MICROSCOPY STUDY OF THE STRUCTURE OF SINGLE MUCIN MOLECULES AND THEIR VISCOELASTIC PROPERTIES

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Epithelial cell surfaces are covered by a protective gel known as mucus. The physiological function of this gel depends on its rheological properties, and these properties of the gel are largely derived from the secreted glycoprotein mucin. The present model for these molecules is that of a long linear strand consisting of highly glycosylated regions linked by cystein-rich globular regions. It is thought that the globular regions may interact either through intermolecular disulfide bonds or through hydrophobic interactions. It has also been speculated that the glycosylated regions may have lectin-like interactions. The viscoelastic properties previously measured likely have been modified from those of the native gel by the large strains applied by the measuring techniques. In the present work single mucin molecules were imaged at high resolution using atomic force microscopy (AFM). The transition from the gel phase to the sol was followed by imaging depositions from solution at increasing dilution. Phase mode imaging was used to monitor the interactions between functionalized AFM tips and these molecules. And, finally, the viscoelastic properties of each solution were measured using the motion of the AFM cantilever in these solutions. The motion of the cantilever is on the order of nanometers and thus applies smaller strains.