

Abstract Submitted
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Hydration Layer of Enzymes Partially Controls Conformational Dynamics¹ ZAHRA ALAVI, Student at UCLA, ZOCCHI TEAM — For a typical (20 kD, 4 nm size) monomeric enzyme, more than 50% of the residues are at the surface. The mechanics of these soft, heterogeneous nanoparticles was recently shown to be viscoelastic. Here we explore the contribution of the enzyme's surface to the mechanics of the molecule. Nano-rheology provides sub-ångstrom resolution measurements of the reversible deformation of the enzyme subject to an oscillatory mechanical stress. We perturb the surface of the enzyme by adding small amounts of DMSO, believed to affect ordering of the enzyme - water interface. We observe a dramatic though reversible change in the mechanics of the enzyme, which becomes more viscous. On the other hand, the catalytic speed is unaffected, while at higher DMSO concentrations (>1 %) it even increases. Our measurements show that small (<1 %) bulk concentrations of DMSO, which have negligible effect on the physico-chemical properties of bulk water, including the viscosity and dielectric constant, have nonetheless dramatic effect on the dynamics of the hydration layer of the enzyme, and ultimately on the enzyme's mechanics. DMSO accumulates in the hydration layer ("binds to the surface of the enzyme"). Apparently the order - inducing ("kosmotropic") quality of DMSO leads to a hardening of the enzyme - water interface.

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