139d Determination of the Effects of Carbohydrates on Protein Stability and Structure

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We've used the combination of capillary electrophoresis (CE) and protein charge ladders, a collection of protein derivatives that differ incrementally in charge, to study the effects of fructose, sucrose, and trehalose on the stability of RNase A and a-lactalbumin. This technique allows one to measure both the change in free energy of unfolding, ΔG , and the change in hydrodynamic radius associated with unfolding in a single experiment. In our earlier work we used this experimental information to show that in the cases studied the change in ΔG at $25^{o}C$ upon the addition of sugar could be entirely accounted for by excluded volume [1], as calculated by the explicit water formulation of scaled particle theory (SPT) [2]. SPT predicts that as we increase the concentration of sugar further we should entire a region where ΔG increases dramatically. Our preliminary experiment results suggest though that in concentrated fructose solutions this is not the case. Other interactions besides excluded volume need to be incorporated in order to explain the experimental data.

[1] O'Connor, T.F.; Debenedetti, P.G.; Carbeck, J.D. *J.Am. Chem. Soc.* **2004**, 126, 11794-95.

[2] Berg, O.C. *Biopolymers* **1990**, 30, 1027-1037.