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Effect of Multivalent Cations and Fatty Acids on the Global Dynamics of Bovine Serum Albumin at High Concentrations

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Most protein studies require dilute conditions, however, in their natural environment, most proteins are surrounded by high concentrations of various biomacromolecules. In such crowding conditions the translational and rotational mobility is reduced, which we analyze by NMR relaxometry and pulsed-field-gradient NMR experiments. Depending on the surface charge structure of the proteins a coupling or decoupling between rotation and translation can be observed. Bovine serum albumin (BSA), the most abundant protein in bovine blood shows an intermediate coupling. Through the addition of trivalent cations the interprotein intermolecular electrostatic interactions can be tuned, which leads to an interesting phase behaviour including reentrant condensation and liquid-liquid phase separation.

In commercially available BSA, naturally occurring fatty acids may or may not be removed depending on the manufacturer, which is often overlooked. We discovered that fatty-acid-free samples show a significant difference in translational diffusion coefficients and relaxation times and protein-salt-interactions which imply an additional retardation of the protein mobility.