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Contributed talk 8 - Towards crowding in the eye lens: dynamics in aqueous solutions of crystallin proteins

Wednesday, 6 June 2018 10:00 (20)

The function of the eye is dependent on a transparent, optically refractive, and deformable eye lens. These specific physical properties are realized by a crowded multicomponent mixture of mainly crystallin proteins within the cells in the eye lens. The underlying biophysical mechanisms are not only of fundamental interest, but highly relevant to better understand and treat eye conditions such as presbyopia and cataract.

We present experimental data on nanosecond dynamics in solutions of α, β and γ crystallins as model systems for the cytoplasm in the eye lens. While cage diffusion and gradient diffusion in α crystallin solutions are consistent with hard sphere systems [1,2], solutions of γ crystallins show clear signatures of short-range attraction, resulting in a significant slowing down of the cage diffusion compared to hard-sphere predictions [1], and critical slowing down of the gradient diffusion [3]. β crystallins appear to have only weak attractive interactions, causing smaller deviations from hard sphere behavior than for γ crystallin.

Based on the dynamics characterised in mono-component solutions, we discuss the effects of mutual protein interaction in mixed solutions of crystallins on the dynamics and arrest behavior. For both mixtures of α / γ crystallins and β / γ crystallins, non-additive effects of the diffusion are observed, suggesting mutual interaction between the crystallins [4].

[1] S Bucciarelli, JS Myung et al. Sci. Adv. 2 (2016) e1601432
[2] G Foffi, G Savin, et al. PNAS 111 (2014) 16748
[3] S Bucciarelli, L Casal-Dujat, et al. JPCL 6 (2015) 4470
[4] A Stradner, G Foffi et al. PRL 99 (2007) 198103

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