Pitfall in deducing diffusion coefficients from quasi-elastic light scattering measurements of chromatin

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Chromatin quaternary structure is highly dependent on the presence of mono and divalent cations in the solvent. With monovalent cations below 20 mM superstructures (solenoids or superbeads) are relaxed into extented beaded strings as observed in electronmicrographs and hydrodynamic experiments; the sedimentation-coefficient is decreasing with lowering the ionic strength. Combining data from sedimentation studies (using the analytical ultracentrifuge) with that from quasi-elastic light scattering measurements the molecular weight (M=C · s/D) can be deduced. This was done while dialysing stepwise the material down to very low salt concentrations. At a first glance the obtained results seem to indicate that the molecular weight decreases with decreasing ionic strength, in contrast to a constant molecular weight as one should have expected.
Apparently two alternative explanations for these observations are possible. One is that the chromatin may dissociate due to relaxation of H1-histone interactions, which had been holding together quaternary structures. Thus, hidden double strand breaks in the DNA could cause a decomposition of the original structures. Such an interpretation may eventually be supported by some data from Butler and Thomas (1). However, a more probable explanation seems to be an abnormal behaviour of the diffusion coefficient when deduced from quasi-elastic light scattering measurements, as it had already been observed on pure DNA and poly-lysin in low ionic strength media (2,3). This conclusion is also supported by experiments during which chromatin was dialysed against solvents with increasing ionic strength. Under these conditions the s-values were about the same as in the preceding experiments, thus indicating that dissociation of chromatin cannot play the decisive role.
The reported results should call attention for a possible pitfall when applying QLS-measurements for deducing diffusion coefficients.

1) Butler, P.J.G., Thomas, J.O., (1980), J. Mol. Biol., 140, 505-529
2) Fulmer, A.W., Benbasat, J.A., Bloomfield, V.A., (1980), Biopolymers, 20, 1147-1159.
3) Lin, S.C., Schurr, W.I., (1978), Biopolymers, 17, 1041-1064.