Electronic Supplementary Material (ESI) for Soft Matter.

Supplementary Information

Ubiquity of Complex Coacervation of DNA and Protein in Aqueous Solution

Priyanka Kaushik[a], P.K. Pandey[a,b], V.K. Aswal[c] and H.B. Bohidar[a*]

[a]School of Physical Sciences, Jawaharlal Nehru University, New Delhi, India

[b]Experimental Physics, Saarland University, 66123 Saarbrücken, Germany

[c]Solid State Physics Division, Bhabha Atomic Research Centre, Mumbai, India

[*]Corresponding author email: bohi0700@mail.jnu.ac.in

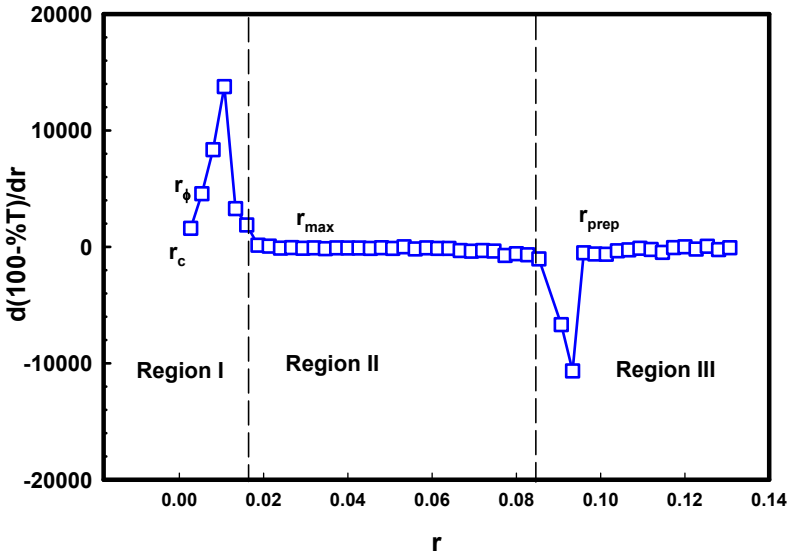

Fig. S1. Variation of turbidity derivative *d(100-%T)/dr* with mixing ratio r= [DNA]: [E]. Spikes in the derivative plot clearly show the transition points r_ϕ and r_{precip} where formation of soluble and insoluble complexes ensue (see text for details). The region bound by r_φ, r_{max} and r_{precip} defines the coacervation region.

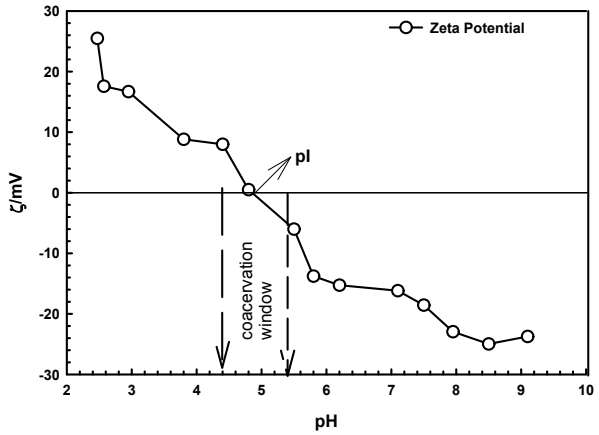

Fig. S2: Variation of zeta potential of elastin (concentration= 0.05 % (w/v)) with solution pH measured at room temperature. In the coacervation window (pH=pI±3) the zeta potential remained in the region 8 to -6 mV.

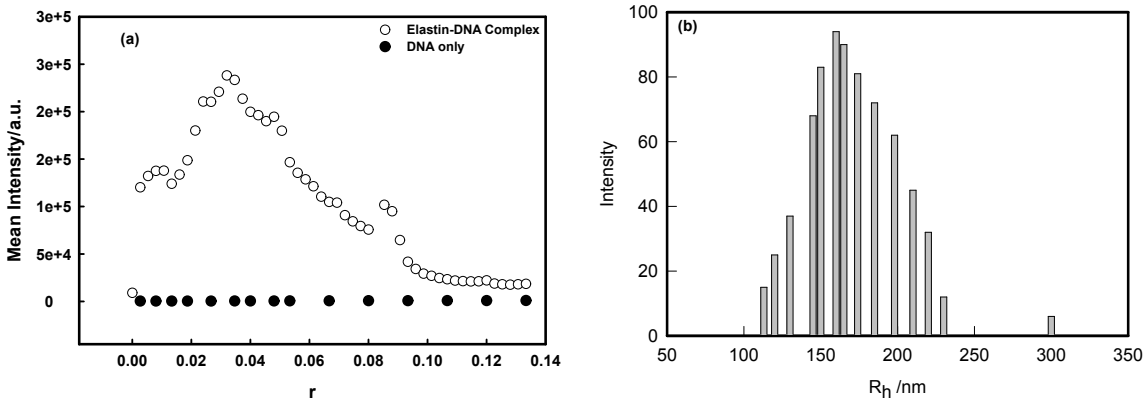

Fig. S3. (a) Variation of scattering intensity for elastin-DNA complex, and DNA alone with mixing ratio r. (b) Size histogram for DNA at concentration 1.33×10^{-4} % (w/v). Mean size =160±16 nm.

S1. SANS Analysis

The scattered intensity from DNA can be represented as

$$I(q)_{DNA} = (\rho_{DNA} - \rho_D)^2 \, C_{DNA} \, M_{DNA} P(q)_{DNA}$$

Where the concentration, molecular weight and form factors are represented as C, M and P(q). Neutron scattering length density of DNA is ρ_{DNA} and same for D_2O is ρ_D.

And the same from elastin will be

$$I(q)_E = (\rho_E - \rho_D)^2 \, C_E \, M_E P(q)_E$$

Hence

$$\frac{I(q)_{DNA}}{I(q)_E} = \frac{(\rho_{DNA} - \rho_D)^2 \, C_{DNA} \, M_{DNA} P(q)_{DNA}}{(\rho_E - \rho_D)^2 \, C_E \, M_E P(q)_E}$$

In the Guinier limit, the form factor is given by

$$P(q) \approx exp - \left({q^2 \, R_g^2}/{3} \right)$$

For both DNA and elastin, $q^2 R_g^2 \ll 1$ which implies P(q) ≈1.

C_{DNA}/C_E= r, $M_E \approx 5x10^4$ Da, and $M_{DNA}=1.6x10^6$ Da. The robust coacervation window pertained to the mixing ratio range of r= 0.0267-0.0933.

Thus, the ratio $\frac{I(q)_{DNA}}{I(q)_E}$ varied between 2 to 8 indicating the dominance of scattering from DNA. Please note that during the formation of soluble complexes, DNA was fully consumed while part of elastin was available as free protein. But this fraction mostly remained in the supernatant and did not make contribution to SANS intensity.