Supplemental information

RNA chain length and stoichiometry govern surface

tension and stability of protein-RNA condensates

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Supplementary information

Energy Term	Parameter Values	Meaning
$k_b^P(r - r_0^P)^2$	$r_0^P = 0.38, \; k_b^P = 10$	Protein chain bonding
$k_b^R(r - r_0^R)^2$	$r_0^R = 0.34, \; k_b^P = 10$	RNA chain bonding
$k_\theta^R(\theta - \theta_0)^2$	$\theta_0 = 1.34, \; k_\theta^R = 1$	RNA chain stiffness
$\dfrac{q_i q_j}{4\pi D r} exp(-\kappa r)$	$D = 80, \quad k = [1, ...3]$	Electrostatic interactions
$\epsilon_{ij}\left[\left(\dfrac{\sigma_{ij}}{r_{ij}}\right)^{12} - \left(\dfrac{\sigma_{ij}}{r_{ij}}\right)^6\right]$	$\epsilon_{ij} = 1$ Values of σ_{ij} come from Dignon et al. Plos Comp Bio 2018	Short-range attraction and excluded volume terms acting between all RNA and protein units

Table S1: Listing of all energy terms describing interactions of coarse-grained molecular models of RNA and RGG along with parameters and their physical meaning; Related to the main figure 1.
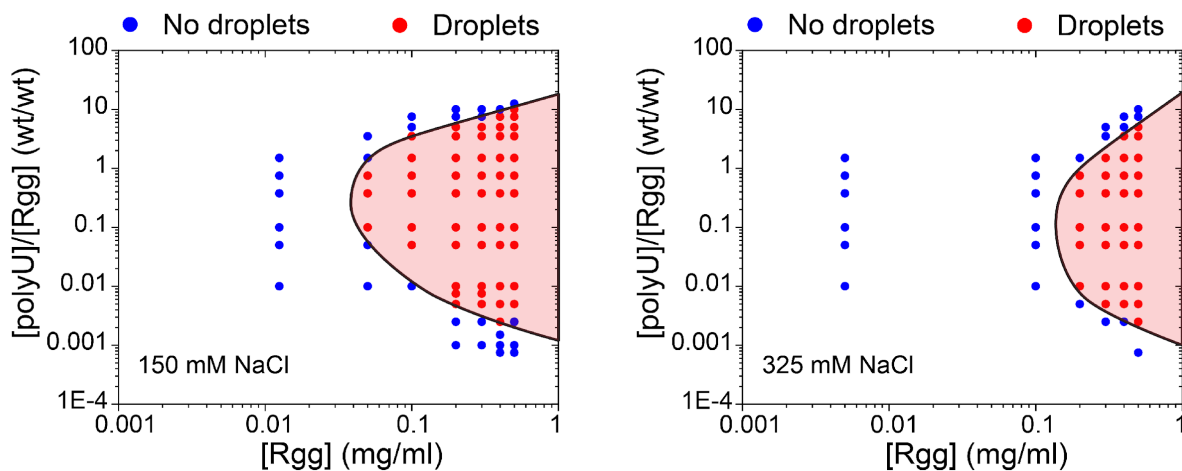

Figure S1. Experimental state diagrams of RGG-PolyU mixtures; Related to the main figure 6. Shown are phase diagrams at 150 mM NaCl (left) and 325 mM NaCl (right). Blue-filled circles indicate a homogenous mixed state. Red-filled circles indicate LLPS. The solid black line is drawn as a guide to the eye. Samples were prepared at the desired RGG and PolyU concentration in a buffer containing 25 mM Tris-HCl (pH 7.5), 20 mM DTT, and the indicated salt concentration.
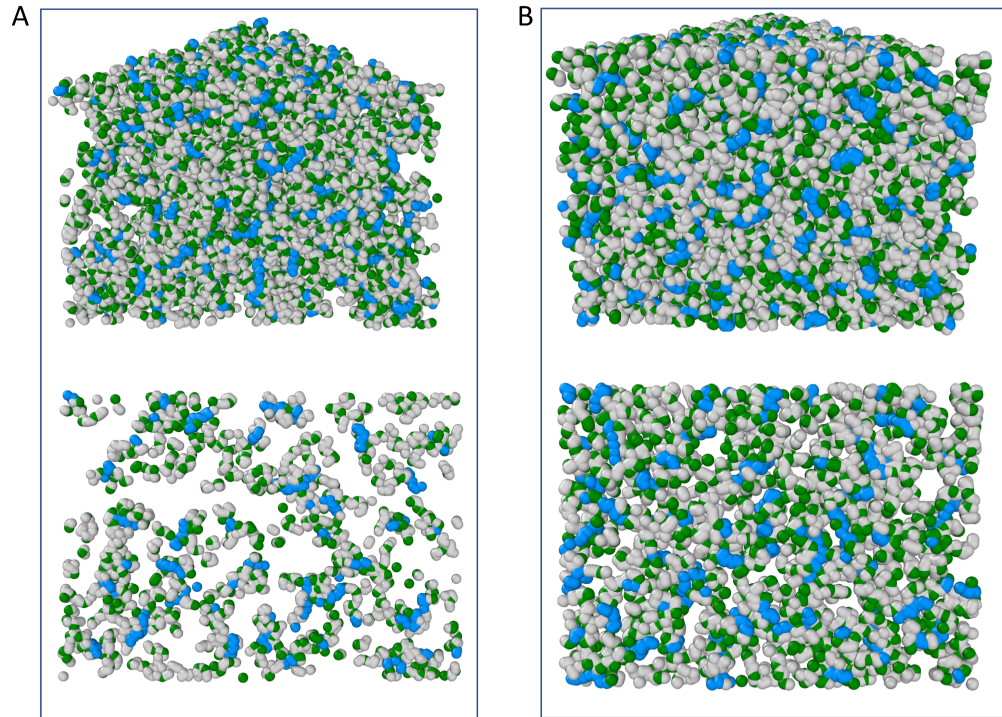
Figure S2. Snapshots of simulations done under NPT ensemble; Related to the main figure 4. Showing snapshots of NPT simulations with (A) P=1 and (B) P=10 conditions demonstrate the potential changes in condensate density that may occur as a function of external crowding. Each panel shows a slice which is taken across the diagonal of a simulation box (top) and a 2nm slab is taken from a simulation box to better show the difference in packing of chains (bottom)
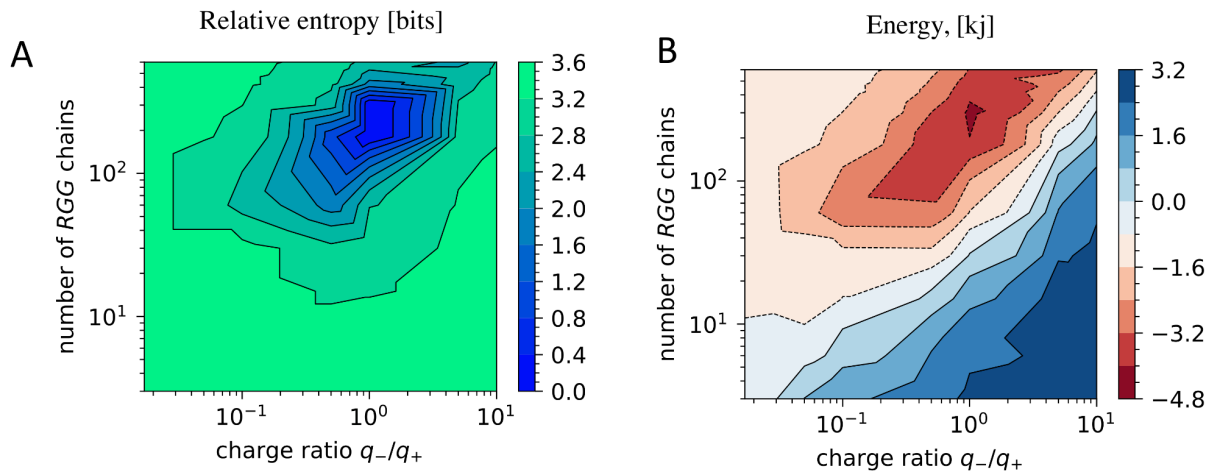

Figure S3. Relative entropy and energies of condensation; Related to the main figure 5 (A) Shannon entropy measure computed by image segmentation of simulation snapshots. Entropy is

measured relative to uniformly dissolved state (B) Average inter-molecular energy accounting for excluded volume, dispersion, and electrostatic forces.