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Wetting of cytosolic protein condensates

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Protein condensates inside human cells are liquid-like droplets composed of protein and RNA. These condensates interact with the heterogeneous, active and dense environment of the cytoplasm, crossed by various cytoskeletal filaments such as microtubules and actin. Wetting interactions with the cytoskeleton lead to stereotypical positioning of such protein droplets inside the cell. Using statistical physics approaches, we identified complementary functions of filamentous actin and microtubules: protein droplets couple to actin' s native dynamics in the cell through steric interactions leading to directional motion towards the cell center. Microtubules (and their molecular building-blocks), on the other hand, act as Pickering agents and engage in energetically favorable wetting interactions that lead to a robust localization of protein condensates in microtubule-rich regions of the cell. These interactions are non-specific and ultimately arise from different affinities (contact angles) between condensate and filament, suggesting that similar mechanisms may govern localization of other liquid-like phases within the cell.

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