Droplet organization of membrane-less organelles: nucleolus sub-compartment formation driven by liquid phase separation

Takeshi SUGAWARA

2016/06/03

Abstract:

In this JC, I focus on a study for sub-compartmentalized organization characteristic of nucleoli. Of many intracellular compartments, membrane-less bodies are comprised of RNA and protein, and are referred to as RNP bodies. These membrane-less organelles maintain a coherent size and shape, with a well-defined boundary that compartmentalizes different types of proteins and RNA. Many of RNP bodies exhibit liquid-like biophysical properties, and growing evidence suggests that they assemble via liquid-liquid phase separation [1-4]. In the paper by M. Feric, *et al*., *Cell* **165** , http://dx.doi.org/10.1016/j.cell.2016.04.047, 2016 [5], they combined in vivo and in vitro studies, together with computational modeling, to show that sub-compartments within the nucleolus represent distinct, coexisting liquid phases. Their results suggest that phase separation can give rise to multi-layered liquids that may facilitate sequential RNA processing reactions in a variety of RNP bodies as well as nucleoli.

References:

[1] Brangwynne, C.P., Eckmann, ... , Hyman, A.A., Germline P granules are liquid droplets that localize by controlled dissolution/condensation. Science ***324***, 1729–1732 (2009).

[2] Brangwynne, C.P., Mitchison, T.J., & Hyman, A.A., *Active liquid-like behavior of nucleoli determines their size and shape in Xenopus laevis oocytes*. PNAS ***108***, 4334–4339 (2011).

[3] Berry, J., Weber, S.C., Vaidya, N., Haataja, M., & Brangwynne, C.P., *RNA transcription modulates phase transition-driven nuclear body assembly*. PNAS ***112***, E5237–E5245 (2015).

[4] Weber, S.C., & Brangwynne, C.P., *Inverse size scaling of the nucleolus by a concentration-dependent phase transition.* Curr. Biol. ***25***, 641–646 (2015).

[5] Feric, M., Vaidya, N., …, & Brangwynne, C.P., *Coexisting Liquid Phases Underlie Nucleolar Subcompartments*, Cell ***165***, http://dx.doi.org/10.1016/j.cell.2016.04.047 (2016).