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C. elegans uses Liquid-Liquid Demixing for the Assembly of Non-Membrane-Bound Compartments CHRISTOPH A. WEBER, FRANK JUELICHER, Max Planck Institute of the Physics of Complex Systems, ANDRES FELIPE DIAZ DELGADILLO, LOUISE JAWERTH, ANTHONY A. HYMAN, Max Planck Institute of Molecular Cell Biology and Genetics , DEPARTMENT BIOLOGICAL PHYSICS TEAM, HYMAN LAB COLLABORATION — P granules are liquid cytoplasmic RNA/Protein condensates known to determine the germ lineage in Caenorhabditis elegans. They resemble striking similarities with liquid droplets, such as dripping, shearing and wetting. Assuming that P granules are liquid-like we consider how they form in the crowded cytoplasm. Using confocal and light-sheet microscopy, P granule formation in-vivo and in-vitro is shown to share all hallmarks with a liquid-liquid phase-separation. Specifically, demixing is determined by temperature and concentration, the droplet formation is reversible with respect to temperature quenches and there is evidence for droplet growth due to coalescence and Ostwald-ripening. Liquid-liquid demixing in-vivo breaks the paradigmatic view that a molecular machinery is necessary to build up organelles through complex biological pathways. Instead we propose that P granules form following a Flory-Huggins model. Liquid-liquid demixing could also serve as a mechanism for the assembly of non-membrane-bound compartments in other living organisms.

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