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DEAD-box ATPases are global regulators of phase-separated organelles and RNA flux

The ability of proteins and nucleic acids to undergo liquid-liquid phase separation has recently emerged as an important molecular principle of how cells rapidly and reversibly compartmentalize their components into membrane-less organelles such as the nucleolus, processing bodies or stress granules. How the assembly and turnover of these organelles are controlled, and how these biological condensates selectively recruit or release components are poorly understood.

We found that members of the large and highly abundant family of RNA-dependent DEAD-box ATPases (DDXs) are global regulators of RNA-containing phase-separated organelles in prokaryotes and eukaryotes. Using *in vitro* reconstitution and *in vivo* experiments, we demonstrate that DDXs promote phase separation in their ATP-bound form, whereas ATP hydrolysis induces compartment turnover and release of RNA molecules. This mechanism of membrane-less organelle regulation reveals a principle of cellular organization that is conserved from bacteria to humans. Furthermore, we show that DDXs control RNA flux into and out of phase-separated organelles, and thus propose that a cellular network of dynamic, DDX-controlled compartments establishes biochemical reaction centres that provide cells with spatial and temporal control of various RNA-processing steps, which could regulate the composition and fate of ribonucleoprotein particles.

Reference: DEAD-box ATPases are global regulators of phase-separated organelles. (2019).

DEAD-box ATPases are global regulators of phase-separated organelles., 573(7772), 144–148.

<http://doi.org/10.1038/s41586-019-1502-y>

Host: Patrick Cramer



Wednesday / 04.03.2020 / 11:00

Max Planck Institute for Biophysical Chemistry
Large Seminar Room / Administration Building

