Molecular principles of mRNA localization

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Abstract:

In eukaryotes asymmetric localization of mRNAs and their local translation is a universal mechanism to generate cellular asymmetry. It is required for such diverse processes as embryogenesis, stem cell division and differentiation of somatic cells. For localization the transcripts are selectively recognized by motor-protein containing particles and actively transported along the cytoskeleton. Despite its importance, the molecular basis of this spatial and temporal control of gene expression is not well understood. We took advantage of the fact that mRNA localization in budding yeast involves considerably fewer core factors than in higher eukaryotes. Here mRNAs are actively transported from the mother to the daughter cell by a myosin-containing complex. At the tip of the daughter cell the mRNAs become locally translated.

Our lab uses biochemical, biophysical and structural approaches to study the assembly of all core components of this mRNA-transport complex in yeast. By in vitro reconstitution of recombinant factors we assemble motile particles with the size of about 1mDa and characterize key features of their biogenesis and activation. A second question we address is how the transport complex specifically recognizes its mRNA targets. Together these insights serve as one of the best-understood examples of how cells generate cellular asymmetry on the molecular level.

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