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Growth Kinetics of Intracellular RNA/Protein Droplets: Signature of a Liquid-Liquid Phase Transition? JOEL BERRY, STEPHANIE C. WEBER, NILESH VAIDYA, LIAN ZHU, MIKKO HAATAJA, CLIFFORD P. BRANGWYNNE, Princeton University — Nonmembrane-bound organelles are functional, dynamic assemblies of RNA and/or protein that can self-assemble and disassemble within the cytoplasm or nucleoplasm. The possibility that underlying intracellular phase transitions may drive and mediate the morphological evolution of some membrane-less organelles has been supported by several recent studies. In this talk, results from a collaborative experimental-theoretical study of the growth and dissolution kinetics of nucleoli and extranucleolar droplets (ENDs) in *C. elegans* embryos will be presented. We have employed Flory-Huggins solution theory, reaction-diffusion kinetics, and quantitative statistical dynamic scaling analysis to characterize the specific growth mechanisms at work. Our findings indicate that both in vivo and in vitro droplet scaling and growth kinetics are consistent with those resulting from an equilibrium liquid-liquid phase transition mediated by passive nonequilibrium growth mechanisms - simultaneous Brownian coalescence and Ostwald ripening. This supports a view in which cells can employ phase transitions to drive structural organization, while utilizing active processes, such as local transcriptional activity, to fine tune the kinetics of these phase transitions in response to given conditions.

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