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**Phase Transitions in the Nucleus: the functional implications of concentration-dependent assembly of a Liquid-like RNA/Protein Body**  
LIAN ZHU, STEPHANIE WEBER, JOEL BERRY, NILESH VAIDYA, MIKKO HAATAJA, CLIFFORD BRANGWYNNE, Princeton University — The nucleolus is a liquid-like membrane-less nuclear body which plays an important role in cell growth and size control. By modulating nucleolar component concentration through RNAi conditions that change *C. elegans* cell size, we find that nucleoli only assemble above a threshold concentration; moreover, the ripening dynamics of nucleated droplets are consistent with the hypothesis that the assembly of the nucleolus represents an intracellular liquid-liquid phase transition. A key question is how this phase-transition is linked to the primary function of the nucleolus, in transcribing and processing ribosomal RNA. To address this, we characterize the localization of RNA Polymerase I, a key transcriptional enzyme, into nucleolar foci as a function of nucleolar component concentration. Our results suggest that there are a small number of key disordered phosphoproteins that may serve as a link between transcription and assembly. Finally, we present preliminary results using a reduced model system consisting of purified nucleolar proteins to assess the ability of nucleolar proteins to drive liquid-liquid phase separation in vitro. These results lay the foundation for a quantitative understanding of intracellular phase transitions and their impact on biomedically-critical RNA-processing steps.

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