



Department of Anatomy & Cell Biology



**Intracellular phase
transitions drive organelle
assembly and size scaling**

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Living cells contain a complex mixture of macromolecules. In eukaryotes, membranes partition these molecules into functional compartments called organelles. However, cells also contain numerous “bodies” that lack an enclosing membrane and instead consist of local concentrations of protein and RNA. Cellular bodies rapidly exchange components with the surrounding cytoplasm or nucleoplasm, raising a fundamental question: how do these structures assemble and stably persist without a membrane holding them together? To answer this question, my lab uses quantitative live-cell imaging and physical modeling of the nucleolus, a prominent cellular body responsible for ribosome biogenesis. In early *C. elegans* embryos, the bulk concentration of nucleolar components determines whether the nucleolus assembles and, if so, its size. These observations are consistent with a first-order phase transition, suggesting that nucleoli form by liquid-liquid phase separation of the nucleoplasm. Indeed, the coarsening dynamics of nucleoli are consistent with theoretical predictions of classical thermodynamic models, despite nonequilibrium activity in the cell. Our results suggest that phase separation represents a new principle of intracellular organization, capable of generating dynamic bodies of appropriate size.

Wednesday, September 28, 2016

11:30 am

Strathcona Anatomy Building

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