

Organizing living matter: the role of phase transitions in cell biology and disease

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My research group aims to elucidate the molecular principles underlying the spatiotemporal organization of the cytoplasm. We are particularly interested in understanding how the cytoplasm changes upon environmental perturbations and stress. Stressed cells undergo controlled changes on many levels to alter their physiology and metabolism. Many of these changes may directly result from alterations in the organization of the cytoplasm. Indeed, our recent work shows that stressed cells form many membraneless compartments in the cytoplasm via a biochemical process known as phase separation. However, the initially beneficial ability to form compartments becomes detrimental with increasing age, because compartment-forming have a tendency to misfold and aggregate and thus are closely tied to aging and the pathogenesis associated with age-related diseases such as amyotrophic lateral sclerosis. Thus, recent efforts in the lab are focused on understanding the molecular links between subcellular organization, membrane-less compartments and age-related diseases.

Selected publications

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