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Nonequilibrium stabilization of an RNA/protein droplet emulsion by nuclear actin

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Actin plays a structural role in the cytoplasm. However, actin takes on new functions and structures in the nucleus that are poorly understood. The nuclei of the large oocytes of the frog *X. laevis* specifically accumulate actin to reach high concentrations; however, it remains unclear if this actin polymerizes into a network, and what, if any, structural role such an actin network might play. Here, we use microrheological and confocal imaging techniques to probe the local architecture and mechanics of the nucleus. Our data show that actin forms a weak network that spatially organizes the nucleus by kinetically stabilizing embedded liquid-like RNA/protein bodies which are important for cell growth. In actin-disrupted nuclei this RNA/protein droplet emulsion is destabilized leading to homotypic coalescence into single large droplets. Our data provide intriguing new insights into why large cell nuclei require an actin-based structural scaffold.