Thursday, December 21, 2017

12:00pm-1:00pm Mathematical Biology -- Kelsey Gasior (University of North Carolina at Chapel Hill) Cytosolic Liquid-Liquid Phase Separations in Multinucleate Cells -- 335 West Hall
Intracellular phase transitions are an emerging mechanism for cell organization. By undergoing these localized phase separations, cells are able to create dynamic membrane-less compartments that help maintain the regulation of biomolecular interactions, localize factors such as RNAs and proteins, and promote specific biochemistry. The utility of liquid-liquid phase transitions and the assembly of cytosolic compartments is especially critical in large, multinucleate cells. Multinucleate cells are common in the biosphere and include skeletal muscle tissue, filamentous fungi, and certain types of cancer. An excellent model organism for studying liquid-liquid phase transitions in multinucleate cells is the branching fungus Ashbya gossypii. In Ashbya, Whi3, an RNA binding protein, works with two different RNA partners to form liquid droplets within the cell. Under normal physiological conditions, Whi3 alone cannot form droplets, in vitro, as this is a phenomenon that only occurs once it is able to bind with RNA. When Whi3 binds with CLN3 transcripts in vivo, these complexes form droplets which cluster around each nucleus, allowing them to maintain an asynchronous division pattern. Similarly, at the growth tips, once Whi3 binds with BNI1, the droplets that are formed help establish cellular polarity. We use the phase field modeling technique, coupled with a modified Flory Huggins free energy, to understand the changes to the volume fractions of Whi3, RNA transcripts, and the complex they form. We report modeling and experimental progress on these cytosolic liquid-liquid phase transitions in Ashbya as they help guide our understanding of the mechanisms behind both droplet formation and droplet properties.