Abstract: NeSA202100oral-12: Meiotic resumption induces changes in the mechanical properties of the oocyte cortex required for establishment of the embryonic axis

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After completing a final round of DNA replication, oocytes can remain arrested in G2 of meiosis I for weeks to decades depending on the species. Oocytes resume meiosis after stimulation with a maturation hormone, undergoing two highly asymmetric divisions to reduce ploidy while retaining most of the cytoplasm in the future haploid gamete. Previous studies of starfish oocyte maturation revealed that following hormone stimulation, oocytes remodel their cortical actin cytoskeleton by downregulating the small GTPase, Rho. This remodeling resulted in a change in the mechanical properties of the oocyte and occurred in the time period leading up to germinal vesicle breakdown. Similar phenomena are observed in mouse oocytes, but the functional role of this remodeling is unknown. To explore the physiological significance of Rho downregulation on oocyte maturation, activated and dominant negative mutants of Rho were expressed, and their effects on known meiotic processes were analyzed. Constitutively active Rho had no effect on polar body formation, nor did it affect cortical granule translocation to the cortex. However, Rho downregulation appeared to be necessary for Dishevelled (Dsh) localization to the vegetal cortex. Dsh is recruited to the vegetal cortex during meiosis and plays a crucial role in determining the site of gastrulation in the embryo. Thus, while there are likely multiple aspects of oocyte maturation affected by Rho and its downstream effectors, we have identified one critical element of meiotic maturation that requires Rho downregulation and cortical remodeling: establishment of the embryonic axis.