

MAR11-2010-020242

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Surface cell differentiation controls tissue surface tension and tissue positioning during zebrafish gastrulation

S.F.G. KRENS¹, Institute of Science and Technology Austria

Differences in tissue surface tension (TST) between different tissue types are thought to guide tissue organization and cell sorting in development. Measurements of TST have been useful to predict the outcome of in vitro cell sorting and envelopment experiments. However, the outcome of cell sorting experiments in vitro often substantially differs from tissue positioning in vivo, raising questions as to the actual contribution of TST to tissue positioning within the developing embryo. Here, we show that surface tension of germ layer tissues during zebrafish gastrulation critically relies on the differentiation of their surface cells. We also show that surface differentiation of the different germ layer tissues varies and is considerably different between the situation in vitro and in vivo, explaining the apparent dissimilar outcome of cell segregation between these two situations. To analyze germ layer TST as a function of surface cell differentiation, we interfere with surface cell properties of germ layer aggregates by misexpressing genes involved in surface cell differentiation specifically within surface cells using the GAL4-UAS system, and measure tissue surface tension using both parallel plate compression and micropipette aspiration techniques. Our data provides evidence in favor of a critical function of surface cell differentiation in modulating TST and subsequently tissue positioning within the developing embryo.

¹In collaboration with C.P. Heisenberg, Max Planck Institute of Molecular Biology and Genetics.