Partnership between potency and architecture: laying the grounds for mammalian embryo development

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Embryogenesis involves a progressive restriction of developmental potential coupled with an increasing complexity of embryo architecture. These events need to be intricately coordinated to ensure successful development. In the case of mammalian pregnancy, the first most fundamental and drastic series of morphogenetic transformations in embryo architecture and potency is initiated during and immediately after implantation: pluripotent embryonic stem cells of the embryo become organized into the first embryonic epithelium as they transit from naïve to primed pluripotency state, the body axes become established and the distinct embryonic germ layers created. Despite the importance of these events, a comprehensive understanding of the molecular mechanisms, transcriptional pathways, and cellular interactions in the spatio-temporal development of the embryo during its implantation stages has been lacking, due to the embryo's inaccessibility within the body of the mother. To overcome these limitations, we have developed a system to culture implanting mouse and human embryos in vitro. I will describe how this has allowed us to provide insight into how architectural features and signaling events integrate to induce the first epithelization and enable emergence of the body plan. I will also show that we can mimic the initial events of implantation development using ESCs both for mouse and human embryos.