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iPSZÜRICH

A Lecture Series Focused on Induced Pluripotent Stem Cells

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STEM CELL-DERIVED MOUSE EMBRYOS DEVELOP WITHIN AN EXTRA-EMBRYONIC YOLK SAC TO FORM ANTERIOR BRAIN REGIONS AND A BEATING HEART

Embryo-like structures generated from stem cells can achieve varying developmental milestones, but none have been shown to progress through gastrulation, neurulation, and organogenesis. Here, we show that mouse “ETiX-embryoids”, established from embryonic stem cells aggregated with trophoblast stem cells and inducible extraembryonic endoderm stem cells, can develop through gastrulation and beyond to undertake neural induction and generate the progenitors needed to create the entire organism. The head-folds of ETiX embryos show anterior expression of Otx2, defining forebrain and midbrain regions that resemble those of the natural mouse embryo. ETiX embryos also develop beating hearts, trunk structures comprising a neural tube and somites, tail buds containing neuromesodermal progenitors and primordial germ cells, and gut tubes derived from definitive endoderm. Notably, ETiX embryos also develop a yolk sac with blood islands. Overall, ETiX embryos uniquely recapitulate natural embryos, developing further than any other stem-cell derived model, through multiple post-implantation stages and within extra-embryonic membranes.

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