STEM CELLS

A mouse blastocyst-like structure from scratch

Researchers show that mouse stem and adult cells can develop into blastocyst-like structures.

The zygote divides to produce 60–100 cells that organize in a hollow ball called the blastocyst, defined by the three embryonic lineages: the placenta-producing trophectoderm (or trophoblast), the embryo-forming epiblast and the primitive endoderm. Studying blastocysts could provide sorely needed insight into early embryogenesis, but these structures are difficult to come by or create in the lab. The first three cell divisions of the zygote produce totipotent cells that can generate blastocysts, prompting scientists to develop protocols to stabilize totipotent-like features in 'extended' pluripotent stem (EPS) cells. However, until now no one has been able to produce a blastocyst from such cells.

An international team led by Juan Carlos Izpisua Belmonte from the Salk Institute in La Jolla, California, has successfully developed a method based on three-dimensional culturing of mouse EPS cells in media with biochemical cues to produce self-assembling, blastocyst-like structures called blastoids. The team also produced EPS-blastoids from adult mouse fibroblasts. Regardless of origin, the resulting blastoids recapitulated key molecular and cellular processes of early development and contained cells from all three blastocyst lineages. Cell counts of each lineage and their transcriptomes on the sixth day of blastoid culture showed that these structures resembled embryonic day 3.5 blastocysts. In vitro culturing of EPS-blastoids allowed them to develop into postimplantation embryo-like structures. Finally, the team implanted the EPS-blastoids into the uteruses of surrogate mice, which induced decidualization and led to (albeit disorganized) development of viable placental and embryonic tissue. While the new model of preimplantation embryos brings promise, it also requires further refinement.

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Published online: 28 November 2019
https://doi.org/10.1038/s41592-019-0674-6

Research paper
Li, R. et al. Generation of blastocyst-like structures from mouse embryonic and adult cell cultures. *Cell* **179**, 687–702.e18 (2019).