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Rhesus embryonic stem cell colonies express marker genes for early embryonic patterning

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It is well established that rodent and primate embryonic stem cells (ESC) can differentiate *in vitro* into many cell types such as muscle cells, hepatocytes, and neurons. However, it is still a contentious issue whether primate ESC can perform a patterning process *in vitro* which recapitulates at least in part the early embryonic patterning *in utero*.

The gene *goosecoid* encodes a transcription factor that can, ectopically expressed in amphibians, induce a second Spemann organizer. In mice, *goosecoid* is expressed transiently at the anteroir end of the primitive streak. Chordin, a secreted protein which antagonizes BMP4, is also expressed in the *Xenopus* organizer and has been shown to induce a secondary axis when extopically expressed. In mice, chordin is expressed in the node and plays a role in subsequent forebrain development. The genes *nodal* (TGF-β family member) and *Ptx-2* (transcription factor) are asymmetrically expressed on the left side of mouse embryos. They obviously play important roles in the establishment of the left-right asymmetry of the embryo.

To get first insights into the developmental potential of primate ESC regarding early embryonic patterning we studied colonies of Rhesus monkey (rh) ESC grown on mouse embryonic fibroblast feeder cell layers. Expression of marker mRNAs for the undifferentiated state of stem cells vs. early embryonic patterning was tested by northern analysis or RT-PCR. Rhesus ESC expressed the stem cell markers Oct-4 and telomerase reverse transcriptase (tert). The primate origin of the amplified mRNA was confirmed by sequencing of the RT-PCR products followed by sequence comparison with the primate and mouse genes. Remarkably, the rhESC colonies also expressed substantial amounts of mRNAs encoding Goosecoid, Chordin, Nodal and Ptx-2, which play important roles in anterior-posterior patterning and the establishment of left-right asymmetry, respectively. Future studies will analyze the expression pattern of the investigated genes within the individual ESC colonies by *in situ* hybridization. These initial data indicate that primate ESC are a very promising model for early embryonic pattern formation *in vitro*.