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Scientists show for first time how early human embryo acquires its shape

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How is it that a disc-like cluster of cells transforms within the first month of pregnancy into an elongated embryo? This mechanism is a mystery that man has tried to unravel for millennia.

The first significant step towards understanding the issue was made nearly a century ago in experiments conducted by the German embryologists Hans Spemann and Hilde Mangold. The two used early newt embryos and identified a group of cells within them which, upon transplantation, formed a two-headed tadpole.

In trying to understand why this happened, they concluded that what occurred is that the transplanted cells organized the vicinity into which they were placed to form a typical embryonic shape. They therefore dubbed such cells "organizer" cells. The newt embryo possessed both its own organizers and the transplanted ones, both of which organized nearby cells to form a head structure.

Recently, Israeli scientists from the Hebrew University of Jerusalem have managed to generate human organizer cells, using human embryonic stem cells. Based on the similarity that dominates the initial developmental processes of all vertebrates, the group raised the human cells in conditions which recapitulate those of early amphibian embryogenesis. Within two days, the human cells started expressing genes characteristic of the organizer cells.

To verify that these cells derived from human embryonic stem cells

posses a true organizing ability, the researchers repeated Spemann and Mangold's experiments. Only this time, the human cells, rather than those of amphibians, were transplanted into frog embryos.

The midline of an amphibian embryo is marked by a neural tube – a tissue destined to form the embryo's central nervous system. To the group's astonishment, some of the frog embryos that were transplanted with the human cells possessed not one but two neural tubes. The second tube was composed from frog cells, proving that the injected human cells organized the cells in their vicinity to acquire a tubular shape.

Provided by Hebrew University of Jerusalem