Surprise role of nuclear structure protein in development

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Scientists have long held theories about the importance of proteins called B-type lamins in the process of embryonic stem cells replicating and differentiating into different varieties of cells. New research from a team led by Carnegie's Yixian Zheng indicates that, counter to expectations, these B-type lamins are not necessary for stem cells to renew and develop, but are necessary for proper organ development. Their work is published November 24 by *Science Express*.

Nuclear lamina is the material that lines the inside of a cell's nucleus. Its major structural component is a family of proteins called lamins, of which B-type lamins are prominent members and thought to be absolutely essential for a cell's survival. Mutations in lamins have been linked to a number of human diseases. Lamins are thought to suppress the expression of certain genes by binding directly to the DNA within the cell's nucleus.

The role of B-type lamins in the differentiation of embryonic stem cells into various types of cells, depending on where in a body they are located, was thought to be crucial. The lamins were thought to use their DNA-binding suppression abilities to tell a cell which type of development pathway to follow.

But the team--including Carnegie's Youngjo Kim, Katie McDole, and Chen-Ming Fan--took a hard look at the functions of B-type lamins in embryonic stem cells and in live mice.

They found that, counter to expectations, lamin-Bs were not essential for embryonic stem cells to survive, nor did their DNA binding directly regulate the genes to which they were attached. However, mice deficient in B-type lamins were born with improperly developed organs—including defects in the lungs, diaphragms and brains—and were unable to breathe.

"Our works seems to indicate that while B-type lamins are not part of the early developmental tissue-building process, while they are important in facilitating the integration of different cell types into the complex architectures of various developing organs," Kim, the lead author, said. "We have set the stage to dissect the ways that a cell's nuclear lamina promote tissue organization process during development."

Provided by Carnegie Institution