

Switch for Self-renewal of Neural Stem Cells Discovered

Institute of Stem Cell Research

Stem cells are multipotent and form different progenitor cells in the developing embryo or in the adult organism. Stem cells also have the characteristic ability of self renewal. If this ability is missing, the number of stem cells decreases continuously during development and no stem cells can then persist into adulthood. Until now the factors that regulate the self renewal of neural stem cells in the developing brain were unknown. Now scientists from the GSF-Institute of Stem Cell Research have shown that the GTPase cdc42 is the key molecule for the self renewal of neural stem cells. GTPases are small molecular switches that activate other proteins when they are bound to the energy carrier guanosine triphosphate (GTP). If GTP is

converted into the low energy form guanosine diphosphate (GDP), the proteins are no longer activated.

The scientists were able to show that cdc42 regulates the self renewal of stem cells in the developing forebrain. Interestingly, cdc42 is enriched at one pole of the neural stem cells and hence is likely to be asymmetrically distributed when the stem cells divide. In this case one daughter cell remains a neural stem cell, while the second develops into a neural progenitor cell from which neurons are generated. If cdc42 is genetically deleted in these cells, the stem cells lose the ability to divide asymmetrically and thus to renew themselves. Instead only neural progenitor cells are formed, which eventually leads to a reduction in the number of neural stem cells.



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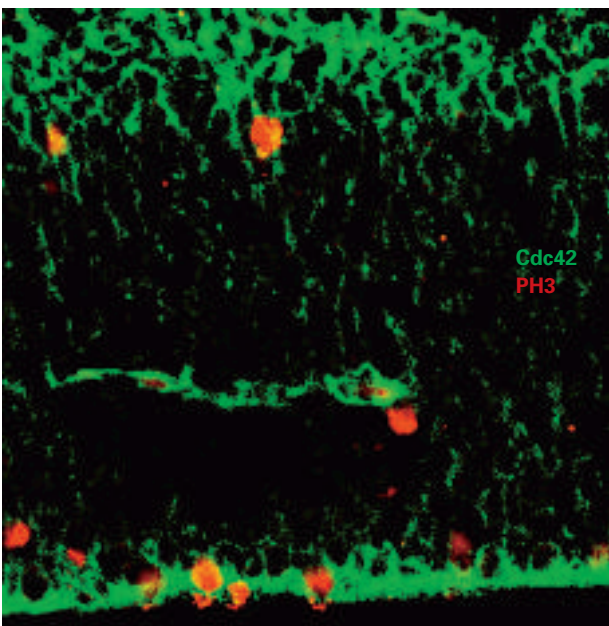
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This research provides a new stimulus for stem cell research: Aging of stem cells is linked to the fact that they gradually lose the ability to self-renew. The exciting findings of cdc42-regulated self-renewal of neural stem cells prompt the hope that stimulation via cdc42 may help to activate self renewal in aging neural stem cells.

Literature:

- Capello, S. et al.: Nature Neuroscience 9, 1099-1107 (2006)



Section through the forebrain of a 14-day mouse embryo. Cells in the M phase of cell division in red (PH3+).

Cover of the above publication.

