

# New study makes key finding in stem cell self-renewal

February 6 2012

---

A University of Minnesota-led research team has proposed a mechanism for the control of whether embryonic stem cells continue to proliferate and stay stem cells, or differentiate into adult cells like brain, liver or skin.

The work has implications in two areas. In [cancer treatment](#), it is desirable to inhibit [cell proliferation](#). But to grow [adult stem cells](#) for transplantation to victims of injury or disease, it would be desirable to sustain proliferation until a sufficient number of cells have been produced to make a usable organ or tissue.

The study gives researchers a handle on how those two competing processes might be controlled. It was performed at the university's Hormel Institute in Austin, Minn., using mouse stem cells. The researchers, led by Hormel Institute Executive Director Zigang Dong and Associate Director Ann M. Bode, have published a report in the journal *Nature Structure and [Molecular Biology](#)*.

"This is breakthrough research and provides the molecular basis for development of regenerative medicine," said Dong. "This research will aid in the development of the next generation of drugs that make repairs and regeneration within the body possible following damage by such factors as cancer, aging, heart disease, diabetes, or paralysis caused by [traumatic injury](#)."

The mechanism centers on a protein called Klf4, which is found in

embryonic stem cells and whose activities include keeping those cells dividing and proliferating rather than differentiating. That is, Klf4 maintains the character of the stem cells; this process is called self-renewal. The researchers discovered that two enzymes, called ERK1 and ERK2, inactivate Klf; this allows the cells to begin differentiating into [adult cells](#).

The two enzymes are part of a "bucket brigade" of signals that starts when a [chemical messenger](#) arrives from outside the embryonic stem cells. [Chemical messages](#) are passed to inside the cells, resulting in, among other things, the two enzymes swinging into action.

The researchers also discovered how the enzymes control Klf4. They attach a small molecule--phosphate, consisting of phosphorus and oxygen--to Klf4. This "tag" marks it for destruction by the cellular machinery that recycles proteins.

Further, they found that suppressing the activity of the two enzymes allows the stem cells to maintain their self-renewal and resist differentiation. Taken together, their findings paint a picture of the ERK1 and ERK2 enzymes as major players in deciding the future of embryonic stem cells--and potentially cancer cells, whose rapid growth mirrors the behavior of the stem cells.

Klf4 is one of several factors used to reprogram certain adult skin cells to become a form of stem cells called iPS (induced pluripotent stem) cells, which behave similarly to embryonic stem cells. Also, many studies have shown that Klf4 can either activate or repress the functioning of genes and, in certain contexts, act as either an oncogene (that promotes cancer) or a tumor suppressor. Given these and their own findings reported here, the Hormel Institute researchers suggest that the self-renewal program of cancer cells might resemble that of [embryonic stem cells](#).

"Although the functions of Klf4 in cancer are controversial, several reports suggest Klf4 is involved in human cancer development," Bode said.

Provided by University of Minnesota

Citation: New study makes key finding in stem cell self-renewal (2012, February 6) retrieved 26 June 2024 from <https://phys.org/news/2012-02-key-stem-cell-self-renewal.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.