Male pattern balding may be due to stem cell inactivation: study

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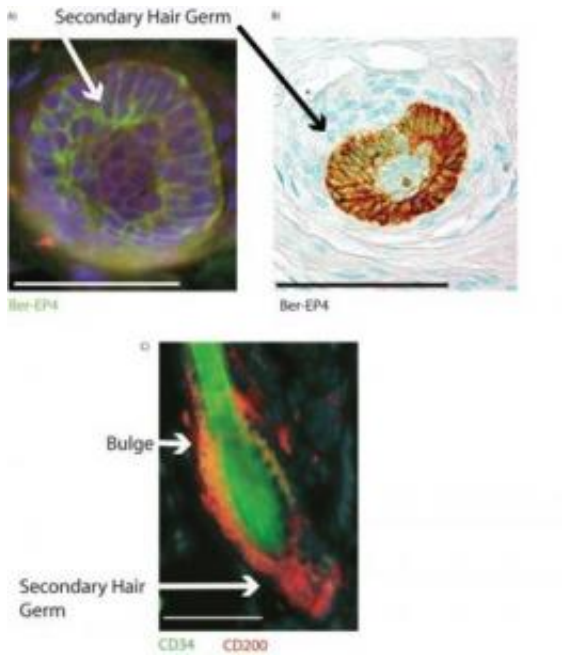

Top panels show progenitor cells marked in green (left) and brown (right) in cross section of a hair follicle. Bottom panel shows side view of hair follicle with stem-cell- and progenitor-cell-rich areas. Credit: George Cotsarelis, MD, University of Pennsylvania School of Medicine

Given the amount of angst over male pattern balding, surprisingly little is known about its cause at the cellular level. In a new study, published in the *Journal of Clinical Investigation*, a team led by George Cotsarelis, MD, chair of the Department of Dermatology at the University of Pennsylvania School of Medicine, has found that stem cells play an

unexpected role in explaining what happens in bald scalp.

Using cell samples from men undergoing hair transplants, the team compared follicles from bald scalp and non-bald scalp, and found that bald areas had the same number of stem cells as normal scalp in the same person. However, they did find that another, more mature cell type called a progenitor cell was markedly depleted in the follicles of bald scalp.

The researchers surmised that balding may arise from a problem with stem-cell activation rather than the numbers of stem cells in follicles. In male pattern balding, hair follicles actually shrink; they don't disappear. The hairs are essentially microscopic on the bald part of the scalp compared to other spots.

"We asked: 'Are stem cells depleted in bald scalp?'" says Cotsarelis. "We were surprised to find the number of stem cells was the same in the bald part of the scalp compared with other places, but did find a difference in the abundance of a specific type of cell, thought to be a progenitor cell," he says. "This implies that there is a problem in the activation of stem cells converting to progenitor cells in bald scalp."

At this point, the researchers don't know why there is a breakdown in this conversion. "However, the fact that there are normal numbers of stem cells in bald scalp gives us hope for reactivating those stem cells," notes Cotsarelis.

In 2007, the Cotsarelis lab found that hair follicles in adult mice regenerate by re-awakening genes once active only in developing embryos. The team determined that wound healing in a mouse model created an "embryonic window" of opportunity to manipulate the number of new hair follicles that form. By activating dormant embryonic molecular pathways stem cells were coaxed into forming new hair

follicles.

In the JCI study, the group also found a progenitor cell population in mice that is analogous to the human cells; these cells were able to make hair follicles and grow hair when injected into an immunodeficient mice.

The researchers say their next steps will be to study the stem and progenitor populations in other types of hair loss, including female pattern hair loss. The information may assist in developing cell-based treatments for male pattern balding by isolating stem cells and expanding them to add back to the scalp directly. They will also focus on identifying factors that could be used topically to convert stem cells to progenitor cells to generate normal large hairs.

Provided by University of Pennsylvania School of Medicine