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Hair Follicles Identified as Probable Home of Skin's Stem Cells

By NICHOLAS WADE

Maybe it is not like discovering a new bone in the human body. But researchers have learned a new fact about human anatomy that could prove just as interesting: the hideout of the source cells that replace those lost every day from wear and tear on the skin.

Those source, or stem, cells turn out to be lurking in the roots of the hair. The finding, if confirmed, could lead to a better understanding of how the skin heals as well as to insights into basal cell carcinoma, a common skin cancer.

Hair follicles, small pockets in the skin from which the hair shaft sprouts, occur in varying density throughout the human skin, except in the palms, soles, foreskin and labia. Even in bald scalps, hair follicles are present and healthy but just arrested in midcycle.

It had already been known that a small bulge on the side of the follicle, just below the surface of the skin, houses stem cells that migrate down to the follicle root and repopulate the hair-making cells. But researchers report in today's issue of *Cell* the surprising finding that the bulge is also home to stem cells for the skin.

These epidermal stem cells migrate up from the bulge into the surrounding skin, the researchers say. Given the general spacing of hair follicles in human skin, a stem cell need only migrate one tenth of an inch to cover half the distance to the neighboring follicle.

The senior authors of the study are Dr. Tung-Tien Sun of the New York University School of Medicine and Dr. Robert M. Lavker of the University of Pennsylvania School of Medicine. The two dermatologists have worked together in search of skin and other stem cells for 20 years.

Their experiment tracking the exodus of stem cells from the follicle bulge was done in mice. But human follicles also have a bulge and it seems likely this is a source of skin cells in people too, said Dr. Elaine Fuchs, a skin biologist at the University of Chicago. Still, there could be other sources of stem cells in human skin, Dr. Fuchs said, particularly in the regions without hair follicles.

She described the work as a "very important finding" because it localized the skin's stem cell compartment and showed that the stem cells in the bulge are pluripotent, meaning they can develop either into hair cells or skin cells.

Most of the body's cells have assumed their final, mature form, and if they divide at all will produce two identical daughter cells. Stem cells, when they divide, produce daughter cells that can either remain as stem cells or develop into mature cells of the relevant type. This means the population of stem cells is continually replenished, acting as permanent reservoir for replacing damaged tissue cells.

Recent discoveries about stem cells in other tissues suggest that the cells are remarkably versatile and that, with the right signals, one kind of stem cell can be converted into another. If stem cells should become an important way of helping to repair the body's tissues, as many biologists hope, the bulge of a patient's hair follicles would be a particularly convenient source.

Dr. Kurt S. Stenn, director of the skin biology research laboratory of Johnson & Johnson in Skillman, N.J., said that the new study was convincing and would advance the use of stem cells for healing the skin because the source of the cells was now known.

Dr. Lavker said he and Dr. Sun had not yet formally proved that a single cell could make either hair or skin. But he said he

believed that if the cells in the bulge received a signal to generate skin cells they would migrate up into the skin; if the cue was to generate hair, they would migrate down into the base of the follicle. The relevant cues have not yet been identified.

The new finding suggests that any form of hair removal that damages the follicles could impair the long-term health of the skin by depriving the area of its stem cells.

Dr. Stenn said that electrolysis, for instance, destroys follicles. But dermatologists do not know why the skin generally seems to escape damage in these circumstances.

Dr. Lavker said his work may help explain basal cell carcinoma, a skin cancer caused by ultra-violet light. The light cannot reach the stem cells in their deep-set bulge but it can derange the stem cell's descendants as they migrate closer to the surface. Dr. Lavker said he believed that these light-damaged cells, which have considerable capacity to proliferate, initiated the cancer.

Biologists do not yet understand the widely varying qualities and distribution of human hair. There is an evolutionary advantage in having no follicles on the palms or soles, Dr. Stenn suggested, because grip is improved by having no hair there.

But how nature arranges for this outcome is not yet known. Dr. Lavker said the copious sweat glands found in the palms and soles are probably the site of these region's stem cells.

Diagram: "A Closer Look: Renewing the Skin" Scientists report that stem cells that can eventually specialize to form skin reside in the hair follicle. Diagram shows close-up view of hair follicle. (Source: Cell)