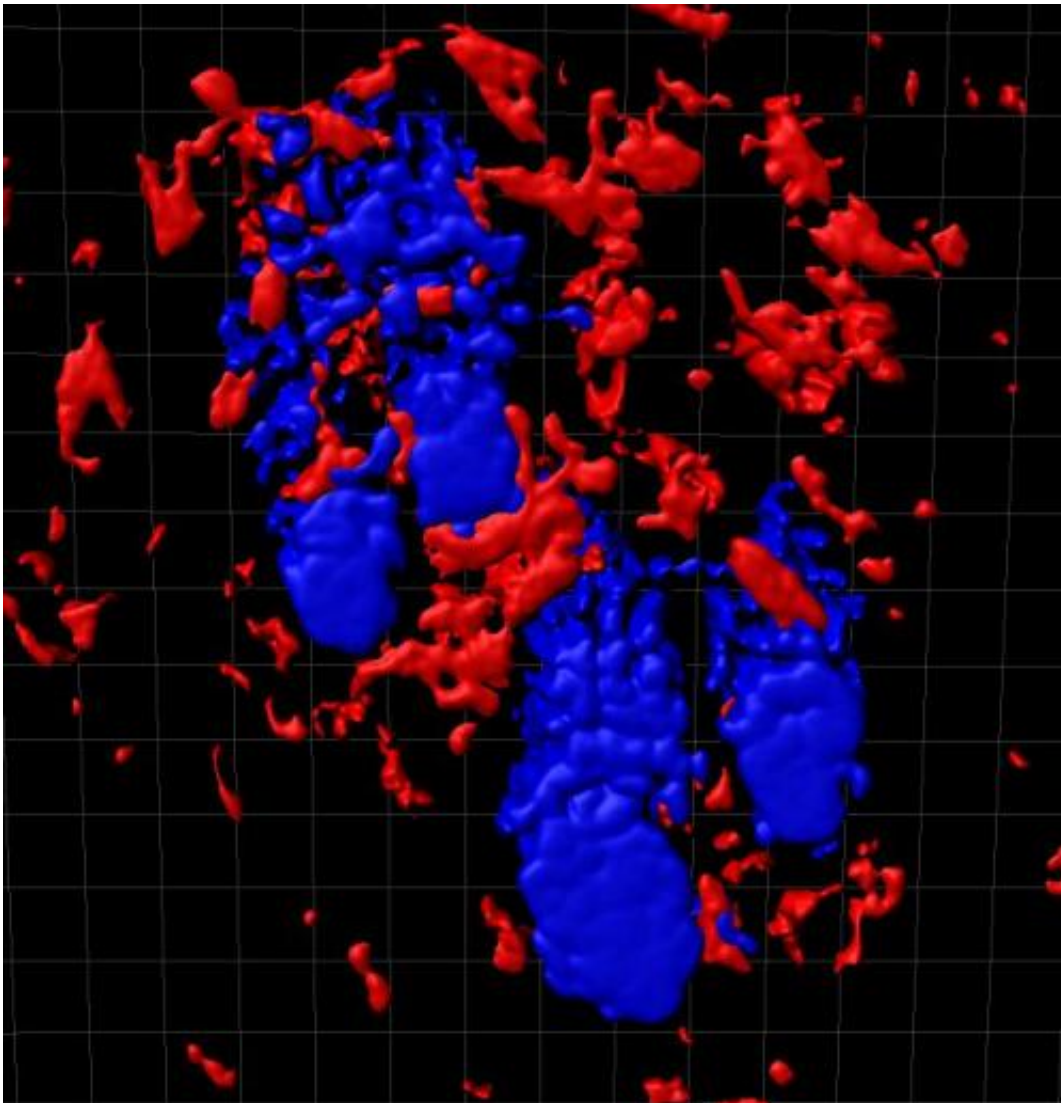


Activating hair growth with a little help from the skin

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Skin whole mount section showing hair follicles (blue) surrounded by clusters of skin resident macrophages (red). The molecular communication between macrophages and hair follicle stem cells regulates the initiation of hair follicle

growth. Credit: Donatello Castellana, CNIO

Restoring hair loss is a task undertaken not only by beauty practitioners. Previous studies have identified signals from the skin that help prompt new phases of hair growth. However, how different types of cells that reside in the skin communicate to activate hair growth has continued to puzzle biologists. An exciting study publishing on December 23 in the open access journal *PLOS Biology* reveals a new way to spur hair growth.

A group from the Spanish National Cancer Research Centre (CNIO) has discovered an unexpected connection—a link between the body's defense system and skin regeneration. It turns out that macrophages are involved. These are [cells](#) from the immune system that are in charge of devouring invading pathogens, a process called phagocytosis. The authors report that macrophages induce [hair growth](#) by surrounding and activating cells in the skin that have regenerative capacity, called [stem cells](#). The discovery that macrophages activate [skin stem cells](#) could influence technologies with potential applications in tissue regeneration, aging, and cancer.

The authors of the study are Mirna Perez-Moreno and Donatello Castellana, from the Epithelial Cell Biology Group of the BBVA Foundation-CNIO Cancer Cell Biology Programme, along with Ralf Paus, a hair immunobiology expert from the University of Manchester and Münster. "We have discovered that macrophages, cells whose main function is traditionally attributed to fight infections and wound repair, are also involved in the activation of hair follicle stem cells in non-inflamed skin," says Perez-Moreno.

These findings emerged from an observation by Perez-Moreno while she was working on another research project. Intriguingly, the mice she was

working with at that time started to regrow hair when they were given anti-inflammatory drugs. Curious as to whether close communication between stem cells and [immune cells](#) could explain this observation, the Perez-Moreno lab began to test different types of cells involved in the body's defense system for a role in hair growth. They observed that when [skin cells](#) are dormant, a fraction of macrophages die naturally due to a normal process called apoptosis. Surprisingly, the dying and surviving cells activated nearby stem cells and hair began to grow again.

Macrophages secrete a number of factors including a class of signaling molecules called Wnts. Importantly, when the researchers treated macrophages with a Wnt inhibitor drug, the activation of hair growth was delayed—demonstrating a role for Wnt from macrophages in promoting hair growth. Although this study was carried out in mice, the researchers believe their discovery "may facilitate the development of novel treatment strategies" for hair growth in humans.

The researchers used tiny droplets, or liposomes, to carry the drug used in the study. The future use of liposomes as a way to deliver a drug to specific cells is promising and may have additional implications for the study of several pathologies, says Donatello Castellana.

From a more fundamental perspective, this research is an effort to understand how modifying the environment that surrounds adult skin stem cells can regulate their regenerative capabilities. "One of the current challenges in the stem cell field is to regulate the activation of endogenous stem cell pools in adult tissues—to promote regeneration without the need of transplantation," says Perez-Moreno.

Because of this study, it is now known that macrophages play a key role in the environment surrounding stem cells. "Our study underlines the importance of [macrophages](#) as modulators in [skin](#) regenerative processes, going beyond their primary function as phagocytic immune

cells," say the authors in *PLOS Biology*.

More information: Castellana D, Paus R, Perez-Moreno M (2014) Macrophages Contribute to the Cyclic Activation of Adult Hair Follicle Stem Cells. *PLoS Biol* 12(12): e1002002. [DOI: 10.1371/journal.pbio.1002002](https://doi.org/10.1371/journal.pbio.1002002)

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