

The Sweet Hair After

Future Hair-Loss Treatments Promise What's not Hair Today will Be Hair Tomorrow.

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Hair today, gone tomorrow. Hair again soon? Maybe, thanks to breakthroughs in hair-loss treatments.

There's been a revolution in biology. Armed with powerful new tools, scientists are learning how to read the complex chemical languages of the body, including how to coin new treatments for hair loss.

Like the cure for cancer, those new treatments aren't nearly ready for prime time. But they're coming, promises George Cotsarelis, MD, director of the Hair and Scalp Clinic at the University of Pennsylvania, Philadelphia.

"In the last 5 to 7 years there has been a boom in the understanding of hair loss," Cotsarelis tells WebMD. "We've made great strides at the level of basic research. Now the question is how we can convert these findings into clinical benefits. Those kinds of leaps really take decades."

The great leap would be to grow new hair on bald heads. But smaller steps aren't that far away.

Why do we care about a cure for baldness? Look around you. Hair loss is extremely common, it usually happens when the normal process of hair growth gets disrupted.

What We Know About Hair

"The hair is real. It's the head that's a fake."

-Steve Allen

Until it's gone, hair is easy to take for granted. But a close look reveals the hair follicle to be one of the most interesting organs of the body. It's most unusual feature: It is self-regenerating.

Hair follicles live just below the top layer of the skin. You have them all over your body except, fortunately, for on your lips, palms, and soles.

At the base of the follicle is the hair bulb, where wildly growing matrix cells become hair.

A little farther up the follicle is the mysterious feature called the bulge. That's where follicle stem cells live. When they get the right set of chemical signals, these self-renewing cells divide. They don't divide like normal cells, in which both halves become new cells that keep splitting and developing. Only one half of the follicle stem cell does that. The other half becomes a new stem cell, and stays put for future regeneration.

Hair growth goes through several distinct stages:

- **Anagen.** The growth phase of hair. An unknown signal tells follicle stem cells to do their thing. Next, the permanent part of the follicle -- the dermal papilla -- gives the "go" signal to hair matrix cells. Those cells grow wildly and become pigmented, creating a new hair shaft. At any given time, 90% of hair cells are in this stage.
- **Exogen.** The new hair shaft pushes the old, dead hair shaft out of the skin. The old hair falls out.
- **Anagen finished.** The new hair extends beyond the surface of the skin and keeps growing. The hair shaft fully matures.

- **Catagen.** The lower two-thirds of the follicle shrivels up and is destroyed. The dermal papilla remains attached to the regressing follicle.
- **Telogen.** The withered follicle rests. It waits for a signal telling it to start all over again.

Losing hair is part of a normal cycle of growth and replacement. Hair follicles go through the growth and resting cycle in a nonsynchronized fashion. But sometimes things go wrong.

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Common Hair Loss Problems: Androgenetic Alopecia

Most of us, when we think of hair loss, think about aging men. Nearly all men eventually get that receding M-shaped hairline and thinning hair on the top of the head, also known as male pattern baldness. It's called androgenetic alopecia, and it's caused by a by-product of testosterone called DHT.

Aging women have a similar problem. Their hair gets thin, although it's not clear that this is necessarily caused by sex hormones.

What is clear is that the same thing happens in aging men and women. Hair follicles get smaller. The anagen stage of hair growth gets shorter, and the resting (telogen) stage gets longer. The result: Thin, very short hairs -- and many follicles empty of hair shafts.

Why is this pattern of hair loss only in the front and on top? That's where hormone-sensitive follicles live. The follicles on the sides and back of the head aren't affected by DHT and usually stay healthy.

Telogen Effluvium

The name is fancy -- telogen effluvium -- but all it means is increased hair shedding. Lots of hair shedding. For various reasons, many hair follicles enter the exogen stage all at once.

The good news here is that hair lost this way almost always grows back in a few months.

Chemotherapy-Induced Alopecia

Cancer cells grow wildly. Chemotherapy takes advantage of this by killing off cells with out-of-control growth. Unfortunately, there's one kind of normal cell that grows like this: Hair matrix cells.

Chemotherapy forces growing follicles into the catagen stage. The hair shaft doesn't develop properly, so the hair breaks and falls out.

The good news is that when chemotherapy is over, the follicles regenerate. Healthy, new hair grows again. The bad news is that, in the short term, chemotherapy causes near total hair loss.

Alopecia Areata

Sometimes a person's immune system attacks the cells of the growing hair bulb. This autoimmune condition is called alopecia areata.

Just as in chemotherapy, hair follicles are forced into the catagen phase. Hairs break and fall out, usually in patches scattered across the scalp.

Sometimes the immune system attacks only the hair bulb. In this case, the hair follicles regenerate when the immune system is brought under control.

Alopecia areata is not related to a more serious condition known as cicatricial alopecia, in which the immune system attacks the stem cells in the bulge of the follicle. This results in permanent hair loss.

Today's Hair-Loss Treatments: Drugs

By now, many people know that men can buy shampoo with an ingredient called minoxidil. Minoxidil -- originally developed as Rogaine -- fights androgenic alopecia in both men and women.

It's still not entirely clear how minoxidil works. And there's disagreement about how well it works. Used properly -- twice a day, massaged deep into the scalp -- it slows new hair loss. It also promotes new hair growth, although experts disagree about how much.

"Two-thirds of men do get acceptable hair growth -- moderate to very good hair growth," Andrew Kaufman, MD, tells WebMD. Kaufman, a hair-transplant surgeon, is assistant professor of clinical dermatology at UCLA, and medical director of the Center for Dermatology Care, Thousand Oaks, Calif.

"Minoxidil definitely has an effect in most men," Cotsarelis agrees. "It is not something a bald person would use, but someone starting to go bald would use it. The goal is to maintain the hair you have."

The other currently approved drug for hair loss is Propecia (generic name, finasteride). It works only for men. Why? It keeps the male sex hormone testosterone from forming its DHT by-product. DHT signals shorten the growth phase -- and lengthen the rest stage -- of hormone-sensitive follicles.

One side effect of Propecia can be loss of libido. But it usually goes away over time, Cotsarelis says.

Testosterone replacement is becoming popular for men. Cotsarelis warns that this may accelerate hair loss. Propecia might help -- but because it prevents testosterone breakdown, it might affect the dose of male hormone replacement therapy. Cotsarelis warns men taking both Propecia and testosterone replacement to make sure their doctor carefully monitors their testosterone levels.

Many men use both minoxidil and Propecia for maximum effect. The drugs can also be combined with hair replacement surgery.

"It's possible to take one or the other or both," Kaufman says. "But if a person isn't going to use Rogaine twice every day, or take the Propecia pill once every day, he shouldn't use them."

Why? Once treatment with either minoxidil or Propecia stops, hair loss resumes -- and any gains soon are lost.

What About Surgery?

One way to combat hair loss is to transplant hair follicles from the sides and back of the head to the top of the head. This surgery has evolved over the years, Kaufman says.

"In the late 1980s, the standard of care was to take large grafts, plugs of 12 to 20 hairs, and implant them," he says. "It would give either a very good or acceptable result. But some men, as they got older and lost some more hair, they got that doll's-hair or corn-row phenomenon: Little poles of hair jutting out."

Today's hair grafts are called follicular unit hair transplants of one to four hairs, transplanted very close together for a more natural look.

Another mostly out-of-favor technique is scalp reduction.

"Scalp reduction is to cut balding scalp out and suture the remaining skin together to reduce the bald area," Kaufman says. "After several of these, you have a smaller area to transplant. But you leave a scar that is visible and needs to be transplanted into to be invisible."

Similarly out of fashion are flap-type procedures, where a flap of hair from a hair-bearing area is partially removed, swung around, and attached to a frontal area. But this can lead to scarring or death of a portion of the scalp.

How well do hair transplants work? That depends. It depends on how much healthy hair a person has available for transplant. And it depends on a person's expectations.

"The best candidate for hair restoration surgery has had hair loss for a number of years but has stabilized and is not losing more hair quickly," Kaufman says. "A person needs to have realistic expectations of what can be done to give them a natural appearing hair line."

Although most people who seek hair replacement surgery are men, Kaufman says women make excellent candidates.

The Future for Hair-Loss Treatments

"There's many a man has more hair than wit."

-William Shakespeare

The Holy Grail of hair-loss treatment is getting shutdown follicles to regenerate. That's what Cotsarelis's lab is working on. Already they've made a major breakthrough: They've learned how to manipulate these stem cells in the test tube.

It's not the only lab working in this area.

"Others are taking hair follicles out of human scalp and growing them with dermal papilla cells," Cotsarelis says. "If they grow in culture, you might be able to recombine them with skin cells and form new follicles. This would let you expand the number of follicles you get for a hair transplant. This may not be that far off -- five to 10 years, maybe. There's very good evidence you will be able to do that."

The company that's leading this research is Aderans -- the huge wig manufacturer based in Japan.

"We are off and running," Tom Barrows, PhD, director of product development at Aderans Research Institute Inc., Atlanta, tells WebMD.

"Hair cloning is something this has been called, but we are not real keen on the word cloning. We are not creating a whole new organism, but it is a duplication process. ... We are taking follicular stem cells -- cells that have capacity of creating new follicle -- and packaging them into follicle-inducing implants. "

A gene called sonic hedgehog is also making headway. A company called Curis already is trying to tame sonic hedgehog for hair growth.

"Sonic hedgehog can convert resting hair into growing hair," Cotsarelis says. "We really don't know it's full role, but if it controls follicle size and growth, it could be something a treatment might be based around."

Sonic hedgehog is just one of several key genes scientists are tinkering with in labs.

If this all sounds futuristic, it is. But there are good reasons this kind of technology will move forward. Today, Americans spend \$800 million on hair restoration surgery. And they'd spend a lot more if the surgery got faster and better.

"If it can be done, it will be done," Barrows says.

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