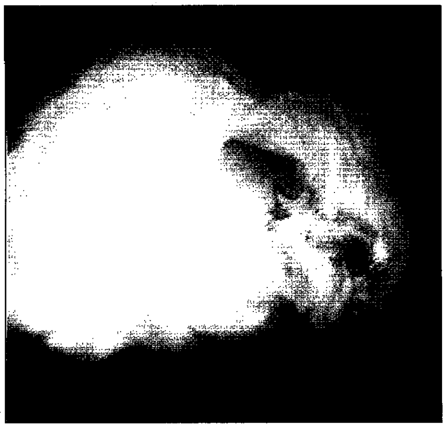
their normal counterparts. "It's really a striking result," says Matthew Scott, a developmental biologist at Stanford University School of Medicine in Palo Alto, California.

Fuchs and her university, which has applied for a patent on the work, see the finding as a possible first step toward harnessing β-catenin or the Wnt pathway to help some



No cue balls here. Mice with extra β-catenin grow thick coats.

30 million balding men in the United States grow new hair. That's not a sure thing, however, especially because the researchers will have to be very careful that such tinkering doesn't trigger tumors—as happened with the Fuchs team's hirsute mice.

Fuchs has long been fascinated by hair because it grows out of a structure, the follicle, that forms and regresses periodically, creating cycles of hair growth and loss. "It's one of the most complex forms of differentiation," she says. She suspected that β-catenin might play a role because of an observation her group made about another protein, Lef1/Tcf, in the skin of early mouse embryos. The researchers found that the protein appears in a dot pattern reminiscent of that displayed by the progenitor cells that produce hair follicles. And because Lef1/Tcf is thought to link with β-catenin to control gene expression, the finding suggested that these two molecules, and the Wnt pathway, might help regulate hair follicle development. That idea was buttressed by what Rudolf Grosschedl's group at the University of California, San Francisco, found when they knocked out the *Lef1* gene in mice: The animals had far fewer hair follicles than the controls.

To test the idea that β-catenin is also involved in hair follicle development, Uri Gat in Fuchs's lab created a new strain of mice carrying extra copies of the β-catenin gene. Before introducing the gene into the animals, Gat had linked it to a regulatory sequence that would cause it to be expressed only in skin cells. He also removed part of the gene so that β-catenin protein could not link up with proteins that would cause it to break down.

Animals carrying this gene not only were hairy critters, but they also got new hair follicles even as adults. Typically, an individual's full complement of hair follicles is set during embryonic development, but in these mice, new ones began to appear within a month after birth. They filled in the spaces between existing hair follicles, but did not form on areas, such as the foot pads, where no hair existed before. Apparently, only the cells in haired skin still had "properties that would allow them to be primed for new hair follicle [growth]," says Fuchs; these properties remain a mystery. The new hairs stuck out in many different directions, however.

The additional β-catenin had darker effects as well. As adults, the mice had hind paws three times the normal size and thickened skin, as well as ridges around the ears, eyelids, and nose. And the mice tended to develop benign tumors in the hair follicles. Humans can develop very similar tumors. Their genetic basis is not known, but the mouse results suggest that β-catenin might be involved; Fuchs is looking for signs of excess β-catenin in the human tumors.

Other goals would be to find the genes that β-catenin turns on to trigger hair follicle development in hopes that they could be activated specifically without causing tumors. Fuchs also wants to determine how β-catenin activation differs in embryonic versus tumor cells. The question is, "can we separate tumorigenesis from hair follicle morphogenesis," she says. If they can, then perhaps her ideas about manipulating the Wnt–β-catenin pathway to cure baldness won't be so hair-raising after all.

–ELIZABETH PENNISI

BIOTECHNOLOGY

Improving Gene Transfer Into Livestock

About 10 years before they startled the world by cloning Dolly the sheep, scientists at The Roslin Institute south of Edinburgh had rocked the scientific community by producing the first healthy sheep carrying a human gene. Since then, a few research groups have used similar gene transfer techniques to build herds of sheep, cattle, goats, and pigs that make human proteins, often with the goal of milking them for valuable drugs. Now, a new method developed by a team of researchers in Wisconsin and California promises to make production of such transgenic livestock much easier than it is today.

Current gene transfer procedures for large animals are time-consuming and expensive, mainly because their efficiency is low: Only 1% to 10% of the animals that develop from eggs inoculated with a foreign gene carry it, and many of those who do can't transmit it to their progeny because

ScienceScope

UN TO MOVE ON GENE RESOLUTION

The United Nations (UN) is nearing approval of a resolution calling for restrictions on human gene research and respect for genetic diversity.

Last week, a UN committee approved the Resolution on the Human Genome and Human Rights, which calls for vigilance against discrimination based on a person's genes and recommends restrictions on human cloning and germline gene therapies, which risk introducing new genes into a population. The resolution also argues that use of human DNA "should not give rise to financial gain"—a controversial issue as companies race for lucrative gene patents.

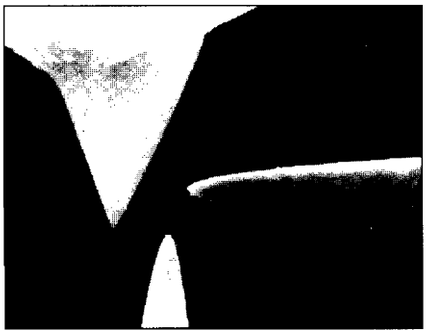
Observers say the panel's endorsement virtually ensures that the measure will pass a 10 December General Assembly vote. But whether nations will adhere to the guidelines is uncertain. Germany and Australia, which are still working on their own policies, have expressed reservations. And the United States pressed to soften the guidelines before endorsing them. Georgetown University bioethicist LeRoy Walters says Americans generally have "less hesitancy" than others about genetic manipulations.

FENCING OVER SWORDFISH

The United States is threatening to retaliate against nations if they violate international swordfish catch quotas. But fisheries experts say the saber rattling won't help stocks—which have declined by 70% since the 1960s—unless quotas are reduced to reflect current science.

At a fisheries summit in Spain last week, U.S. officials warned the 21 other signers of a swordfish and tuna treaty that they may impose trade sanctions against nations that violate the limits, which were set in 1996 and cut the yearly kill in half. But conservationists are pushing the nations to close a loophole that allows undersized swordfish to be discarded and not counted in the catch. "Compliance with insufficient regulations is not going to solve the problem," says Lisa Speer of the Natural Resources Defense Council. Whether the treaty signers buy that argument won't be known until later this year.

LINDA DEGENSTEIN AND CHUCK WELLEK; (BOTTOM) MERCURY ARCHIVES/THE IMAGE BANK



Nanojig. Robotic tips bend, stretch, and prod carbon nanotube.

says physicist and team leader Rodney Ruoff of Washington University.

Ruoff says it's too early to tell how much force it takes to break a single nanotube because the resolution of their SEM is insufficient to judge whether they are looking at a single nanotube or several. The team is hoping to answer that question using a more sensitive SEM or a higher resolution transmission electron microscope. After that, Ruoff says they plan to try welding nanotubes to each other, and then the real construction will begin. –ROBERT F. SERVICE

Looking South to the Early Universe

A flash of news from the Hubble Space Telescope: The distant universe looks about the same in two opposite directions. When the Hubble was aimed at a small patch of northern sky for 10 days in 1995, astronomers believed that their time exposure had captured a typical sliver of the distant universe. But it never hurts to check. At the beginning of October, they followed up on the original Hubble Deep Field (HDF) with a 10-day exposure of a nondescript patch of sky near the south pole—and found similar swarms of faint galaxies, some of them among the most distant and earliest ever seen.

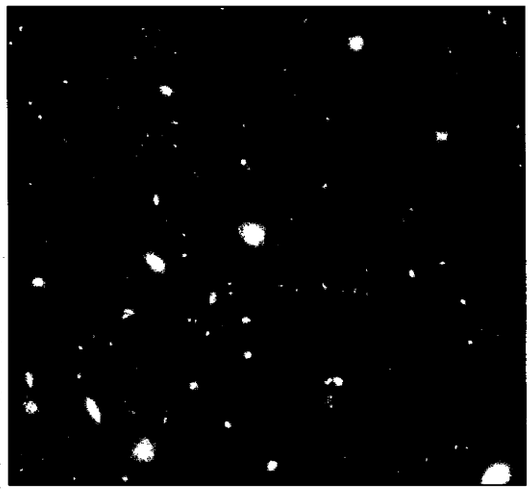
That outcome may sound prosaic, but it's very welcome news to astronomers. "It was crucial to check on our assumption that the HDF is typical of the universe" with a second line of sight, says Alex Filippenko, a galaxy expert at the University of California, Berkeley. And the new view is more than just a reprise of the first: Instruments installed on the orbiting telescope since 1995 have enabled it to harvest far more detail this time around.

"We should call the new results not the Deep Field South but the Southern Fields," says Robert Williams, former director of the Space Telescope Science Institute in Baltimore and now a staff astronomer there, who devoted much of his "director's discretionary time" to the northern and southern deep fields. "This time we obtained three separate images, and comparisons among them will yield significant new results" about how galaxies formed and evolved.

One of the southern images was made with the same camera system used in 1995. Equipped with color filters, it recorded the galaxies' colors, which hold clues to their distances. The reddest galaxies, their light "redshifted" to longer wavelengths by the expansion of the universe, are likely to be the most distant. A second field, slightly offset from the first because it was made with a different instrument, the NICMOS infrared camera, may have captured even more distant galaxies, their light stretched all the way into the infrared. And a third field, recorded with the Space Telescope Imaging Spectrometer (STIS), broke light from the early universe into spectra that may yield new details about galaxy formation.

The HDF and the Southern Fields both record cosmic history, because they offer not a snapshot but a palimpsest of cosmic epochs, seen one behind another out to the most distant galaxy. Already, astronomers studying the HDF have traced how galaxy shapes and numbers change over time. "Look at the [most distant] galaxies: There's not a normal-looking one among them" in comparison with nearby galaxies, seen after 12 billion to 14 billion years of cosmic evolution, says Harry Ferguson, an associate astronomer at the Space Telescope Science Institute.

The STIS image in the new Southern Fields could flesh out this picture by showing how clouds of intergalactic gas fed galaxy formation long ago.



CREDITS: (TOP) ZYVEX LLC; (BOTTOM) R. WILLIAMS/STSCI/THE HUBBLE DEEP FIELD-SOUTH TEAM/NASA

Déjà vu, almost. The clutter of galaxies, up to 12 billion light-years away, in Deep Field South resembles the northern view.

REPORT ON R&D STRAINS COULD STRESS ACADEMIA

The White House is finishing a report defining its relationship with the research community. But the document, a 2-year effort in response to concerns that those ties are fraying, may disappoint academic administrators seeking relief from a handful of regulations they say drain their schools' time and wallets.

White House sources say the interagency report, expected out in draft form in January, concludes that the relationship is strong but in need of attention. It reaffirms the importance of peer review and of both teaching and research in training students and asks agencies to set uniform policies on scientific misconduct. But it ducks such contentious issues for universities as the tax status of graduate students and recommends further study of how to simplify federal accounting practices and whether to remove limits to recovering the full cost of administering federally funded research.

Milton Goldberg, head of the Council on Government Relations, which last year funneled complaints from university administrators to the panel, says he's glad the report upholds the value of the government's investment in research. But he warns that individual federal agencies need clearer guidelines to avoid "subverting" such principles when they set policies for specific programs.

EUROPEAN UNION AGREES ON R&D BUDGET

The European Union's R&D program finally got a budget last week. After lengthy negotiations, a council of research ministers and the European parliament agreed to spend $18 billion over the next 4 years on the 5th Framework research plan, which supports projects jointly funded by the 15 EU nations.

The sum was less than parliamentarians had pushed for, but it was still the first real increase the program has seen since 1990. But only next year's $3.7 billion outlay is definite, because Spain pushed through a "guillotine" clause. It allows Spanish officials to renegotiate spending if they conclude next year that some regions aren't getting a fair share of the EU's full 2000-2002.

Parliamentarians are grumbling about the uncertainty. But members of the Framework's commission are "rather pleased with the outcome" because the program can begin without delay, says a spokesperson.

Contributors: Jennifer Couzin, David Malakoff, Jeffrey Mervis, and Judith Redfern