CLIMATE CHANGE

Polar Bear Listing Opens Door to New Lawsuits

The Bush Administration's decision last week to list the polar bear as a threatened species is about to spark a new round of litigation over greenhouse gas emissions. After analyzing climate models that predict the bear's sea ice habitat would continue to shrink due to global warming, the U.S. Department of Interior ruled that the animal deserves some protection under the Endangered Species Act (ESA). Several environmental groups are preparing to use the ruling to argue that cuts in greenhouse gases are now legally required to protect the polar bear, whereas conservative legal groups are planning to challenge the ruling itself.

When he announced the polar bear's new status, Interior Secretary Dirk Kempthorne tried to preempt litigation to force cuts in greenhouse gases. No specific source of these gases, Kempthorne asserted, will kill any individual polar bear, so the ESA doesn't require power plants, refineries, or even the nation's fleet of automobiles to reduce their emissions. But attorneys on both sides of the long-running legal war over endangered species predict that some courts will reject that argument. "The secretary can't dictate to the courts how they interpret the law," says M. Reed Hopper, a principal attorney for the Pacific Legal Foundation (PLF) in Sacramento, California, a conservative critic of environmental regulation. "I think the environmentalists will find sympathetic judges who will rule that there is a causal connection and give them standing to bring their suits."

Bearing witness. Lawsuits will use the polar bear's "threatened" status to seek changes in U.S. climate policy.

Kassie Siegel, an attorney for the Center for Biological Diversity (CBD) in Joshua Tree, California, is leading the environmentalists' strategy. The "attempt to exempt greenhouse gas emissions is illegal and won't stand up," she says. CBD, Greenpeace, and the Natural Resources Defense Council jointly filed their initial legal challenge on 16 May. Siegel, who also filed lawsuits that forced the government to list the polar bear, plans to argue that the ESA requires every government agency to consult with polar bear experts at the U.S. Fish and Wildlife Service before taking any step that could increase emissions of carbon dioxide. Such steps include authorization of oil and gas drilling, issuing permits for coal-fired power plants, or writing new fuel-economy standards for sport utility vehicles and trucks. "It's high time that federal agencies rolled up their sleeves and did what they're supposed to do on greenhouse emissions," she says.

Some environmentalists doubt that such lawsuits ultimately will reduce greenhouse gas emissions. "I think it's highly unlikely that any court will say, 'This source of emissions has to be halted because it's adding to the burden of carbon dioxide, which is melting ice in Alaska,' " says Michael Bean, a specialist on wildlife conservation at the Environmental Defense Fund in Washington, D.C. Such legal actions could, however, capture public attention, says Holly Doremus, a professor of environmental law at the University of California, Davis. "It can really help people agree that, 'Okay, we've got to act. And we've got to act now.' "

Meanwhile, PLF has announced that it will challenge the Administration's polar bear decision in court. Hopper says it makes no sense for the government to declare the polar bear threatened while insisting that it can do nothing to change the situation. "A listing that cannot address the alleged problem … should not have occurred," says Hopper. "The listing can't affect the melting, but it does open the floodgates to litigation."

Even some environmentalists say the ESA isn't well-designed for dealing with the broad impact of climate change. Doremus points out that global warming may create new dilemmas that the law didn't foresee. "Suppose we decide we can't save

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The Threat to the World's Plants

A day after polar bears made headlines last week, the world's leading botanical gardens issued a call to remember threatened plants, too. Their new report, *Plants and Climate Change: Which Future?* makes the case for protecting the botanical foundations of terrestrial life. "If you read any report about the impact of climate change, it's almost always about polar bears or tigers," said Suzanne Sharrock, director of Global Programmes for Botanic Gardens Conservation International (BGCI) in London and a co-author of the report.

But BGCI, a network of 2000 organizations involved in plant conservation, says climate change could kill off half of Earth's plant species. Plants that grow on islands or on mountainsides are at greatest risk because they have "nowhere to go" as the climate shifts around them.

BGCI also announced its own global effort to catalog and preserve threatened plants. It will update a 10-year-old survey of the world's trees, identifying species that need additional protection in their native habitat and collecting others for preservation in botanic gardens and arboreta. BGCI plans to reintroduce some threatened plants into their former habitats.

Thomas Lovejoy, president of the H. John Heinz Center for Science, Economics and the Environment in Washington, D.C., welcomed the new initiative. "At the outset, plants were scarcely mentioned in the Endangered Species Act. Now, it's an integral part," he notes. **–D.E.C.**

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all species. Which ones should we concentrate on? The law doesn't allow us to give up easily," she says. "But in situations where we may have to give up on some, we may need better mechanisms for triage." And Bean finds it "worrisome" that "you have a species that is at risk of extinction, but the law that was designed to protect endangered species lacks the tools to deal with the threat."

More animals may also be called as witnesses in the fight against U.S. climate change policy, as the polar bear is far from the only animal threatened by the shrinking field of arctic ice. Ice-dwelling mammals such as the Pacific walrus and several species of seals "are in even worse shape," says G. Carleton Ray, an environmental scientist at the University of Virginia, Charlottesville. CBD has already filed petitions demanding that the ribbon seal and Pacific walrus also be listed as threatened.

–DAN CHARLES

Dan Charles is a freelance writer in Washington, D.C.

MICROBIOLOGY

Bacteria Are Picky About Their Homes on Human Skin

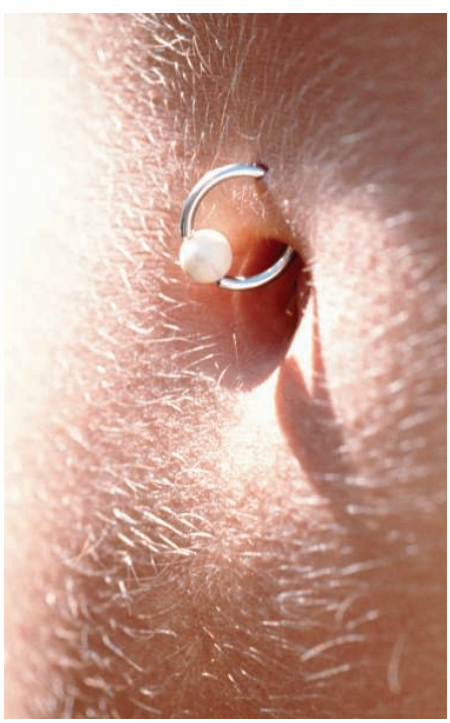
Julie Segre is touring the microbial landscape of our body's biggest organ, the skin. In anticipation of a $115 million, 5-year effort by the U.S. National Institutes of Health (NIH), she's traveling from head to toe, conducting a census of some of the trillions of bacteria that live within and upon human skin. Although their project is just getting off the ground, Segre, a geneticist at the National Human Genome Research Institute (NHGRI) in Bethesda, Maryland, and her colleagues have already uncovered a surprising diversity and distribution among skin bacteria. And a few oddities have emerged, too: Microbes known mostly from soils like healthy human skin, living in harmony with us; and the space between our toes is a bacterial desert compared to the nose and belly button.

Segre's work on what bacteria live where "is cool stuff," says Steven Salzberg, a bioinformaticist at the University of Maryland, College Park. "We need to increase our own and the public's awareness of the diversity and quantity of bacterial species on our own skin. The more people are aware, the more we can do to control infection."

Bacteria and other microbes that colonize our skin and other tissues outnumber the human body's cells 10 to 1, forming dynamic communities that influence our ability to develop, fight infection, and digest nutrients. "We're an amalgamation of the human and microbial genomes," says Segre. Recognizing this, NIH last year designated the Human Microbiome Project as one of its two Roadmap initiatives (*Science*, 2 June 2006, p. 1355). Researchers will sequence the genomes of about 600 bacteria identified as human inhabitants and get a handle on the 99% of bacteria that defy culturing but thrive in the skin, nose, gut, mouth, or vagina. "You have to understand what is the normal flora in the healthy skin to understand the impact of flora on disease," says Kevin Cooper, a dermatologist at Case Western Reserve University in Cleveland, Ohio.

As a first step, Segre, NHGRI postdoctoral fellow Elizabeth Grice, and their colleagues have studied five healthy volunteers, swabbing the insides of their right and left elbows. The site chosen isn't as unusual as it sounds; people with eczema often develop symptoms there. To survey the full thickness of skin, the researchers also used a scalpel to scrape off the top cells. And to reach even deeper, they took small "punches" of skin, a procedure akin to removing a mole.

From all the samples, Grice, Segre, and colleagues pulled out 5300 16*S* ribosomal RNA genes, which vary from microbe to microbe. After lumping together the most similar 16*S* genes, they came up with 113 kinds of bacteria and identified these dermal residents by matching the 16*S* genes to those of known bacteria. (Segre described the results at a recent meeting at Cold Spring Harbor Laboratory, and they are being published online 23 May in *Genome Research*.) "That's a lot of diversity, a lot of different organisms," says Martin Blaser, a microbiologist at New York University, who has done a similar survey of microbes living on the forearm, also finding a lot of diversity.



More than skin-deep. DNA surveys of the belly button, inner elbows, and elsewhere reveal diverse microbial communities.

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Yet just 10 bacteria accounted for more than 90% of the sequences. Almost 60% of the 16*S* genes came from *Pseudomonas*, Gram-negative bacteria that flourish in soil, water, and decomposing organic debris. The next most common one, accounting for 20%, was another Gram-negative soil and water bug, *Janthinobacterium*. Neither had been considered skin microbes before this census. Although there were some differences among the volunteers in the microbes present, their elbows did share a common core set of microbes, the group reports.

The three sampling methods yielded slightly different results, with "punches" revealing a surprising number of bacteria under the skin—1 million bacteria per square centimeter compared with 10,000 from the scrapes. "I would have thought under the skin there would be fewer," says Salzberg.

Segre and her team have also begun sampling 20 other skin sites, including behind the ear and the armpit, from the bodies of volunteers. Skin varies in acidity, temperature, moisture, oil accumulation, and "different environments select for different microbes," says Blaser. Bacteriawise, reports Segre, "no subsite is identical."

Some researchers suspect that shifts in the makeup of skin microbial communities activate the immune system to cause diseases such as eczema. "If you know what the [healthy] flora is, then one strategy is to recolonize the area with the right flora," says Cooper.

–ELIZABETH PENNISI

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