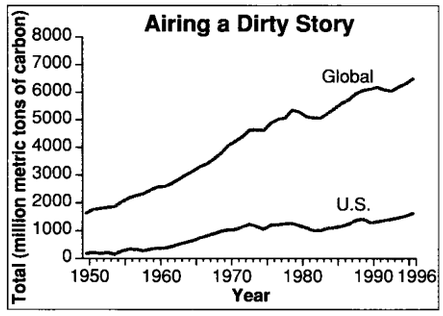
preparing for Kyoto, Wirth has been hosting a monthly seminar on environmental issues that is often focused on global change. Briefers have included National Oceanic and Atmospheric Administration climatologist Dan Albritton and economist Robert Repetto of the World Resources Institute. OSTP also has been holding briefings for policy-makers struggling to respond to the data. "The issue now is not so much whether we have a problem," says presidential science adviser and OSTP director Jack Gibbons. "It's what to do that's sensible and effective."

The Administration has been getting input from other sources as well. The U.S. Global Change Research Program and OSTP are holding meetings to discuss the regional impacts of global change in an effort to fine-tune the analysis of global warming. "We can now take what we've learned on a global scale over the past decade and focus that research on regional scales," says Robert Corell, head of geosciences at the National Science Foundation and chair of the federal interagency committee that coordinates global change research.



Filling up. A steady rise in carbon emissions from all sources is fueling calls for binding limits.

The President's Council of Advisors on Science and Technology (PCAST) is also involved. It held a meeting on 9 June during which the president and PCAST discussed global change, and since then a panel headed by Holdren has been preparing a report on U.S. energy research and development during the next half century that is due by 1 October—just in time for the planned White House conference. A similar meeting held during the Bush Administration ended in disarray after squabbling over uncertainties in the science and the best ways to limit emissions. This time around, say Administration officials, greater consensus over the science should make for a more harmonious gathering.

If so, it would help the Administration meet what many scientists and government officials agree is the most important immediate challenge: making a strong case to the public. "The American people still need to be convinced," says William Schlesinger of Duke University. "It's a very skeptical jury out there."

–Steve Olson

Steve Olson is a science writer in Bethesda, Maryland.

BIOTECHNOLOGY

Transgenic Lambs From Cloning Lab

Just 4 months ago, a lamb named Dolly became an instant celebrity: She is, of course, the first animal ever cloned from the cells of an adult (*Science*, 7 March, p. 1415). Virtually unnoticed at the time, however, was the birth of three other lambs cloned from fetal, rather than adult, cells. But they may have more practical import: In a big step toward developing domestic animals with designer genomes, the Roslin Institute of Edinburgh, Scotland, and the Scottish biotechnology company PPL Therapeutics—the two institutions that cloned these lambs—have now combined the fetal-cell procedure with genetic engineering.

On 24 July, they announced the birth of five more lambs cloned from fetal cells. What distinguishes this new bunch from Dolly and her cohorts is that these animals carry extra genes—a few even have a human gene—that the researchers introduced into the cells before they were cloned. PPL has refused to disclose the identity of the human gene, but researchers say the achievement could aid efforts to develop livestock that produce human proteins, such as blood-clotting factors, for therapeutic use. Although other technologies have been used to create domestic animals that carry such human "transgenes," they are both time-consuming and have a low success rate. "This is a big deal," says Randall Prather, an embryologist at the University of Missouri, Columbia. "It's a way that we can finally make transgenic [domestic] animals efficiently."


JOHN CHADWICK

Transgenic lamb. Polly, who has a human gene, was cloned from fetal cells.

To make the new set of animals, the Scottish team, led by Roslin embryologist Ian Wilmut, first exposed fetal skin cells called fibroblasts to DNA that included both the human gene they were trying to transplant and an undisclosed marker gene. After eliminating cells that didn't express the marker gene, the researchers tested to see which of the remaining cells also took up the human gene.

Wilmut's team then followed the same cloning strategy they used to make Dolly. They first removed the nuclei from mature egg cells and used a brief electrical pulse to fuse the enucleated eggs with the engineered fibroblasts, which had been starved of nutrients. The pulse also jump-started the developmental program—with the genetic instructions now coming from the fetal-cell DNA. In the final step, they placed the eggs in ewes to develop.

The team used fetal cells and not adult cells because the fetal cells have been more efficient in getting an egg to develop, resulting in about one live birth for every 60 nuclear transfers, says Wilmut. The team has achieved about the same success rate with genetically engineered cells, he reports. All five of the new lambs carry the marker gene, and one—named Polly—has already proved to have the human gene in her cells, although the Scottish team has not demonstrated that the gene is expressed. Two more lambs came from cells carrying the human gene, but the researchers have not yet confirmed that the gene is in those lambs.

The birth of Polly already proves, however, that the foreign DNA in the fibroblast genome did not disrupt the genetic instructions that guide the lamb's development. "That is important," says George Seidel, a physiologist at Colorado State University in Fort Collins. In addition, the procedure seems to work in pigs and cows. Steve Parkinson, president and CEO of Advanced Cell Technology in Amherst, Massachusetts, says his company has been using genetically altered fetal cells and nuclear transfer technology to produce cow and pig fetuses whose nerve cells are collected for possible use in treating Parkinson's disease. The company is now allowing some fetuses to proceed to term and expects to have newborns later this year, Parkinson notes.

The technique should facilitate the development of animals with customized genomes, including those that have had genes knocked out as well as added. The procedures could help, say, in improving prospects for xenotransplantation by removing immunogenic proteins from pigs whose organs would be used for replacing ailing human ones.

Some experts caution, however, that it will be some time before these procedures make their commercial debut, because lengthy and expensive clinical trials will be needed to show that the proteins or cells produced by these animals are safe and effective. But Wilmut is optimistic, in view of the rapid progress so far. "We're pleased that we got to this stage so quickly," he says.

–Elizabeth Pennisi