

tured set of donors. Once the DNA has been sampled, however, all personal and racial data will have to be removed to protect privacy—diminishing the scientific value of the project, but bolstering its ethical foundation.

Where those samples would come from—and how to ensure that donors have given appropriate consent and that their privacy is safeguarded—prompted the most intense debates. NHGRI staffers had set their hopes on getting a set of ready-made cell lines containing DNA from a broad sample of the U.S. population, created by the National Center for Health Statistics (NCHS). From 1989 to 1994, that agency's National Health and Nutrition Examination Survey (NHANES) collected blood from more than 17,000 representative individuals around the country to obtain a snapshot of the health of the U.S. population. Karen Steinberg of the Centers for Disease Control and Prevention later converted more than 8000 of these samples into immortalized cell lines. But Chakravarti warned that "it is not a done deal" that genome researchers would be allowed use this material. The reason: Because DNA studies had not been foreseen, NHANES staff did not ask the donors for per-

mission to put their DNA in a database.

Managers of the NHANES data asked their human subject research panel for guidance on this issue more than a year ago. In September, the panel said it would be acceptable to run some health studies on the cell lines, but only if the samples were made completely anonymous by stripping them of all identifiers (*Science*, 21 November, p. 1389). Edward Sondik, director of the NCHS, has interpreted this ruling to mean that DNA data from these samples cannot be put in a database—even with anonymous identifiers—without consent, because a third party who knows the name and genes of an individual might still be able to ferret out unique genetic information.

But the prospect of asking for fresh consent from donors concerned NHANES officials. As Diane Wagener of NCHS explained, they worry that if people receive a letter informing them that their DNA has already been immortalized in cell lines and requesting approval for hard-to-understand genetic studies, they might say, "I don't want to have anything to do with [NHANES]."

As the cell lines seemed to become less accessible by the hour, an annoyed Collins

declared that, after months of discussion, "I am very troubled to learn that there still doesn't seem to be a clear answer" about whether they can be used. After a coffee break, Sondik announced that 600 DNA samples that are not part of the primary NHANES set will be made available for the SNP project, and possibly a small fraction of the primary set, as well. Consent will have to be obtained from the donors, only 75% of whom are expected to be reachable through old addresses. But even with a strong response, the NHANES contribution will not be enough. For example, it is short on Asian and Native American DNA. NHGRI will therefore have to find other donors, perhaps among patients in ongoing NIH projects.

The NHANES samples will, at least, allow the SNP project to get started. Now NHGRI staffers must lay out the technical parameters, the sequencing goals, deadlines, and cost limitations. They hope to complete all of this by January. Then, if the whole scheme doesn't run into a wall, the genome community will witness a brand-new competition in gene discovery.

—Eliot Marshall

CLIMATE CHANGE

Thirty Kyotos Needed to Control Warming

When exhausted delegates emerged from round-the-clock negotiations in Kyoto, Japan, last week with a global agreement to curb emissions of heat-trapping gases, some observers hailed the deal as a diplomatic miracle. Climate scientists say, however, that it will be miraculous indeed if the Kyoto pact—which calls for 38 industrialized nations to cut their emissions by an average of 5.2% from 1990 levels by 2012—even temporarily slows the accumulation of warming gases in the atmosphere. The cuts are too small and are likely to be overwhelmed by developing nations, they say. "It is a laudable and reasonable first step," says Jorge Sarmiento of Princeton University, "but much deeper emissions cuts will be needed in the not too distant future if we are going to meaningfully reduce the rate of warming."

If approved by major industrialized nations such as the United States and Japan—and that is far from certain—the new Kyoto Protocol to the 1992 Climate Change Treaty could reduce emissions of six greenhouse gases, including carbon dioxide, methane, and nitrous oxide. The United States—the world's leader in greenhouse emissions, with 25% of the total—agreed to a 7% cut from 1990 levels by 2012, while the 15 nations of the European Union committed themselves to an 8% reduction and Japan to 6%. If the cuts are achieved, industrialized nations will reduce their collective

greenhouse emissions to two-thirds of what they would be in 2012 without action, according to the United Nations.

Even this significant reduction, however, won't prevent total global greenhouse emissions from rising, analysts predict. The cuts will be swamped early in the next century by increases in emissions from developing nations, such as China and India, which successfully resisted being bound by the protocol. For example, China, currently in second place, is ex-



Haze over Beijing. Emissions from developing nations like China could overwhelm Kyoto cuts.

pected to overtake the United States as the world's leading emitter of carbon dioxide within decades, as it burns more of its massive coal reserves. From 1990 to 2015, the U.S. Energy Information Administration predicts, carbon dioxide emissions from developing

countries—including Russia and Eastern European nations—will nearly double, and will account for 58% of the global total even if industrial countries do not cut back.

At that rate, the 1992 treaty will not achieve its major objective—stabilizing atmospheric concentrations of carbon dioxide—says Tom Wigley, a climate researcher at the National Center for Atmospheric Research in Boulder, Colorado. Currently, carbon dioxide levels stand at about 360 parts per million (ppm), up from preindustrial levels of 280 ppm. Computerized climate models created by Wigley and others suggest that concentrations will at least double by 2100 unless developing nations hold their emissions steady and industrial nations progressively reduce emissions by roughly half.

"A short-term target and timetable, like that adopted at Kyoto, avoids the issue of stabilizing concentrations entirely," Wigley says. As a result, it will at best delay the predicted warming trend by just a few decades. Jerry Mahlman, director of the Geophysical Fluid Dynamics Laboratory at Princeton, adds that "it might take another 30 Kyotos over the next century" to cut global warming down to size.

Still, says Sarmiento, "you have to start somewhere, and the protocol at least provides a framework for revisiting the issue as our understanding improves."

—David Malakoff

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