And they agreed that when and if there is a test capable of detecting 95% of the carriers, it should be offered to everyone of reproductive age, perhaps 100 million people in the United States. Even then, they said, screening should only begin if a counseling program for education is in place.

But what happens if the test is never able to detect more than, say, 80 or 85% of the carriers? Should it be denied to the large number of couples who could nonetheless be helped? Hopkins geneticist Neil Holtzman, for one, is not so sure. Even now, with today's limited test, it is a tricky call, he says. "The problem with not screening with a 75% test is we miss the opportunity to reduce the disease in 50% of those affected." Cystic fibrosis is now the most common lethal genetic disease, affecting 1 in 2500 newborns.

Robert Williamson of St. Mary's Hospital Medical School in London agrees with Holtzman: "We have to learn how to deliver it to the 50 to 60% of the population who can benefit. I don't think we have a choice."

Others, like Michael Kaback, president-elect of the American Society of Human Genetics and chairman of the pediatrics department at the University of California, San Diego, Medical School, fear that screening with an imperfect test will do more harm than good, especially for those couples who receive inconclusive results. For now, if one partner is positive and one negative, there is no way to tell if the negative one actually does carry the disease gene, but with one of the as yet unidentified mutations. With today's test, 1 in 15 couples will be left in this genetic limbo, and Kaback suspects their anxiety will be tremendous and that some may even end up aborting healthy fetuses.

After grappling with the issue for a day and a half, the NIH panel reached no conclusion on what to do if trapped in this murky middle ground. Nevertheless, they managed to agree on some guidelines for population screening, if and when it comes about: that it should be voluntary and confidential; that it should be available to all who want it, though they advise against testing newborns and children; that informed consent be required; and that laboratory quality assurance begin immediately. They put the onus on health care providers to ensure that adequate education and counseling are available before they offer testing.

The group also recognized that the demand for testing is likely to continue to grow, even if a near perfect test can never be developed. Consequently, they called for pilot programs, to start right away, to determine how best to deliver a cystic fibrosis test and to measure just how much anxiety it produces. ■ LESLIE ROBERTS

Ozone Destruction Closer to Home

Researchers appear to have forged another link in the chain connecting man-made chlorofluorocarbons (CFCs) to losses of protective ozone over the populous mid-latitudes of the Northern Hemisphere. From Oslo to New Orleans, the ozone screen has thinned about 5% during the winter months of the past 10 years. The question: Is the ozone being destroyed by CFCs, in which case things could get worse, or are less sinister, natural variations behind the decline?

The finger of suspicion pointed to the CFCs a year ago when an airborne expedition probing the Arctic stratosphere found an abundance of ozone-destroying chlorine from CFCs (*Science*, 24 February 1989, p. 1007). But expedition researchers had their hands full showing that the chlorine was actually destroying the Arctic ozone. Now it may have finally been caught in the act.

The first direct evidence against CFCs as the culprit comes in a series of papers published in this month's *Geophysical Research Letters*, a special issue devoted to results from last year's expedition. As summarized in a prologue by atmospheric physicist Richard Turco of the University of California, Los Angeles, and others, the papers show that "the initial phases of a widespread ozone depletion apparently were observed."

The Arctic losses are a far cry from those seen every October in the Antarctic ozone hole, however. In the Antarctic, as much as half of all the stratosphere's ozone has been destroyed in some years, with the losses reaching more than 95% at some altitudes. Over the Arctic, total ozone destruction probably did not exceed a few percent and the hardest hit layers, those at and just above 20 kilometers, might have lost only 15 to 20% of their ozone.

Pinning down such small losses was not easy. For example, during the 39 days when the 1989 Airborne Arctic Stratospheric Expedition, as it is officially known, was collecting data, ozone concentrations within the 3000-kilometer-wide vortex of winds that swirl around the Arctic stratosphere actually increased below 20 kilometers as high-altitude, ozone-rich air sank into the vortex. So the challenge was to see whether the ozone increase was less than it should have been.

Participants in the Arctic expedition approached this problem by using the concentration of nitrous oxide, a relatively stable gas, as a benchmark against which to measure any loss of ozone. By determining the relative ozone and nitrous oxide concentrations, a multi-institutional group headed by atmospheric physicist Mark Schoeberl of NASA's Goddard Space Flight Center in Greenbelt, Maryland, found an ozone loss at around 20 kilometers of $15 \pm 10\%$ (95% confidence limits) during the expedition.

There was another detection of apparent ozone destruction, this one by a group headed by Edward Browell of NASA's Langley Research Center in Hampton, Virginia. Browell's group detected two patches of air that had up to 17% less ozone than the surrounding air. The nitrous oxide data again seemed to require chemical destruction of ozone. In addition, the altitude range of the patches, 17 to 23 kilometers, coincided with that of the polar stratospheric clouds. In the Antarctic ozone hole, these icy clouds catalyze the production of ozone-destroying chlorine. The coincidence of ozone loss and clouds in the Arctic implies the same may be happening there.

Despite this evidence, there are still doubters, but the link between CFCs and ozone loss was buttressed by calculations by three different groups of the amount of ozone that should have disappeared during the expedition, given the chemical state of the atmosphere at its start. Although the groups all used different modeling approaches, the results agreed "quite well with the limited observations of actual Arctic ozone variations," note the authors of the special issue's prologue.

Now that new evidence has been found that CFC-derived chlorine is destroying ozone within the Arctic vortex, the next step is to find out whether the Arctic vortex is exporting ozone-depleted air and ozone-destroying chlorine to the mid-latitudes. Such atmospheric transport could be behind the decreased wintertime ozone there. Making this connection will be particularly difficult, however, and politicians considering whether to decrease ozone destruction by further reductions of CFC emissions will probably have to settle for less than a perfect chain of cause and effect.

■ RICHARD A. KERR