But the issue is complicated by the fact that the Colliding Beam Accelerator now has rivals for the intermediate machine slot, the most serious being the "Dedicated Collider" proposed to the Woods Hole group by Fermilab.

The dedicated collider idea has been around for some time as a possible next step after the Tevatron, although the approach of the Woods Hole meeting has certainly given it impetus. Its ring would nearly fill the existing Fermilab site outside of Chicago, and would bring protons and antiprotons together head on at 2 TeV per beam. (In another version it would be an electron-proton machine.) This is five times the energy of the Colliding Beam Accelerator. On the other hand, the collider's luminosity would be lower by a factor of 100. In any case, the Fermilab device would use the same magnet design already proved in the Tevatron, allowing the whole system to be built for a relatively modest $370 million.

Thus, as Wojcicki's committee heads toward Woods Hole, the fate of the Colliding Beam Accelerator is far from clear. The members are not in a mood to rubber-stamp anything, and, says Wojcicki, they may well want to question whether *any* intermediate machine should be built. Might the effort to fill this supposed "gap" in the late 1980's actually drain the ongoing programs and delay the 20-TeV machine?

This is more than a question of hardware, he points out. "One of the things the Woods Hole panel will be addressing is the vitality of high energy physics," he says. When young students make career decisions, a major factor is the opportunity and excitement that they see in a given field. "It is important to have vigorous new facilities to attract and retain these people," he says.

Wojcicki concedes that such statements can seem utterly self-serving—and sometimes are. (In a recent speech to the American Physical Society, for example, presidential science adviser George A. Keyworth felt compelled to make scathing reference to high energy physicists' "pet projects" and "pork-barrel squabbles," and to call for a show of statesmanship.) But the issue is real.

"I think it would be a mistake to build accelerators or detectors just to give people something to do," says Wojcicki. In fact, if the country built the wrong machine (that is, an unexciting machine) it would sap the vitality of the field. The question on the Colliding Beam Accelerator or any other accelerator is simply this: is it a machine that will do worthwhile physics?—**M. Mitchell Waldrop**

Invasion by Alien Genes

Two species of mice that live commensally with humans are found in Europe. To the west is *Mus domesticus* while to the east is *Mus musculus*, closely related species that nonetheless can readily be distinguished by certain anatomical features and a small but distinct difference (about 5 percent) in their nuclear genes. What a surprise, then, to discover that the commensal mouse in northern Denmark and further up into Scandinavia is clearly *Mus musculus* as defined by its anatomy and nuclear DNA but is *Mus domesticus* in the composition of the DNA of its mitochondria.

This discovery, recently reported in the *Proceedings of the National Academy of Sciences* by Stephen Ferris and his colleagues at the University of California, Berkeley, and the University of Aarhus, Denmark (*1*), bears on the traditional definition of a biological species. According to the traditional view a species is "a group of individuals whose common gene pool is protected against the inflow of alien genes." The Scandinavian *Mus musculus* has clearly suffered an inflow of alien genes, to the point where its mitochondrial genome is indistinguishable from that of another species.

A second case of two closely related but distinct species sharing a common mitochondrial genome, also recently published in the *Proceedings*, indicates that the phenomenon might be quite common (*2*). Jeffrey Powell of Yale University reports nuclear and mitochondrial DNA data on two species of fruit fly from California, *Drosophila pseudoobscura* and *Drosophila persimilis*, that reveal a pattern similar, although somewhat less clear-cut, to that from the European mice. Powell says that these data should not be taken to question the validity of the species concept but biologists should be aware that "the evolutionary biology of nuclear and cytoplasmic genomes may be different."

Mitochondrial DNA differs from that in the nuclear genome in a number of ways, in addition to being outside the nucleus: it exists in thousands of copies per cell; it evolves five to ten times faster; and it is maternally inherited (when a sperm and an ovum fuse, each contributes half the nuclear genes but only the egg cell contains significant numbers of mitochondria). This last difference, plus some putative selective advantage of one species' mitochondrial DNA over that of another, has apparently allowed the flow of mitochondrial genes between species while the flux of nuclear genes has remained more restricted.

Along the boundary known as the hybrid zone, where *Mus domesticus* and *Mus musculus* populations are contiguous or overlap, occasional breeding across species occurs, giving rise typically to subfertile offspring. From a comparison of patterns of DNA framents obtained by cutting mitochondrial genomes with restriction enzymes, Ferris and his colleagues have concluded that the *Mus musculus* population seen today in northern Denmark was established by a colonization event within the last 100,000 years, perhaps involving a single *Mus domesticus* female as the source of the alien mitochondria.

A hybrid produced through mating between a male *Mus musculus* and a female *Mus domesticus* would have a mixed nuclear genome, but its mitochondrial genome would be entirely that of *Mus domesticus*. Repeated crossing of these descendants with *Mus musculus* would quite rapidly dilute out the *Mus domesticus* component of the nuclear genome but the mitochondrial genome would remain that of *Mus domesticus* (through the female line at least). Ferris and his colleagues speculate that the spread of the *Mus domesticus* mitochondrial genome throughout the *Mus musculus* population in northern Scandinavia might be a consequence of an adaptive or replicative advantage possessed by the *Mus domesticus* mitochondrial DNA.

Like Powell, Ferris and his colleagues see no need to abandon the biological species concept as currently understood, but they do "forsee the possible need for defining species in terms of their nuclear genes."

—**Roger Lewin**

References

1. S. Ferris *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **80**, 2290 (1983).
2. J. Powell, *ibid.*, p. 492.