embrace the full range of biodiversity information including geographical, ecological, genetic, and molecular data. A third activity will be to digitize all biodiversity information, now usually embodied specimens in museums continents away from where the samples were collected. "Repatriation of data is a major impetus," says Meredith Lane, vice president for biodiversity at the Academy of Natural Sciences in Philadelphia and a member of the bioinformatics working group. But that process, by which the host country would obtain electronic access to information stored in another country, will require an enormous and sustained effort. "We have 30 million insects on pins, many very small and fragile with tiny hand-written labels. At our current rate of progress, [cataloguing these specimens electronically] would take centuries," says Blackmore.

Of course, all this will take money. And despite the official go-ahead, none has yet materialized for GBIF. The working group has estimated that GBIF will end up coordinating some $40 million a year in ongoing work within member countries, and that GBIF itself can make an important contribution at an annual cost of $8 million a year. But such a budget, paid by member nations, is probably a few years away.

As a first step, science ministers from Australia, Denmark, the United Kingdom, and the United States have signaled their intention to contribute toward the $2 million to $3 million needed to set up a six-person secretariat at a site to be determined. Australia and the United Kingdom are seen as likely bidders for the administrative headquarters, to open next year. Although the United States is unlikely to put in an application, says James Edwards of the National Science Foundation, it is strongly committed to the project. "There is some activity going on now to mobilize data, and there are sporadic efforts to put it on the Internet," he says. "But there's no capacity for the one-stop shopping needed for nations to carry out the CBD and to develop their own biodiversity programs. That's what GBIF will do."

–JUDY REDFEARN

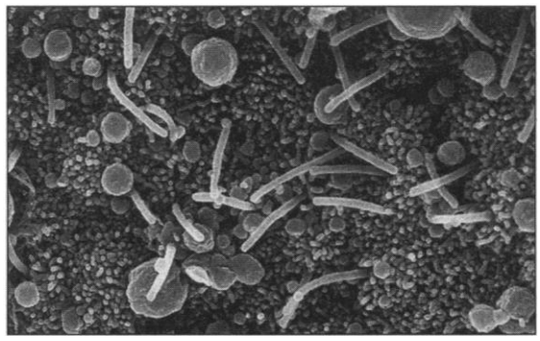
Judy Redfearn writes from Bristol, U.K.

DEVELOPMENTAL BIOLOGY

How to Get a Heart in The Right Place

CHARLOTTESVILLE, VIRGINIA—Like a child learning to put her hand over her heart for the Pledge of Allegiance, a developing embryo needs to know its right from its left. The heart goes on the left and the liver on the right, but how the embryo knows which is which is a long-standing puzzle. At the annual meeting of the Society for Developmental Biology here last month, one promising theory—that twirling "hairs" on embryonic cells set up the left-right distinction—gained strength.

Scientists first proposed a connection between cilia—whiplike protrusions that can propel cells and help keep airways clear—and organ placement nearly 25 years ago. In 1976, Bjorn Afzelius described how human patients with a genetic defect called Kartagener's syndrome have immotile sperm and defective cilia in their airways—and about half have their organs on the wrong side (*Science*, 23 July 1976, p. 317). That connection led to speculation that cilia might somehow help to direct organ placement, but no one knew whether Kartagener's syndrome disables the cilia in the embryo as well.



Turn, turn, turn. Twirling cilia on the node cells of a developing embryo may distinguish its left from its right.

CREDIT: S. POTTER, UNIVERSITY OF CINCINNATI AND J. DUNLAP, UNIVERSITY OF TENNESSEE

The old theory was resurrected 6 months ago, after cell biologist Nobutaka Hirokawa of the University of Tokyo and his colleagues reported that when they knocked out a gene involved in cilia assembly in mice, about half the animals had reversed left-right organ placement, and all lacked cilia on so-called node cells. These cells produce many of the signals that direct the early patterns in a mouse embryo, and the node is the site of some of the first molecular differences between left and right.

When the team made microscopic videos of normal node cells, they found that their cilia rotated counterclockwise, unlike the back-and-forth motion of cilia on sperm or in airways. By tracking fluorescently labeled beads, the scientists determined that the cilia somehow swept the fluid surrounding the cells to the left. That might cause an as yet unknown signal to accumulate, eventually leading to asymmetric organ development. The lack of this lateral cue in the mutant strain could explain the 50% rate of organ reversal.

But other researchers had trouble repeating the technically difficult observations, and many remained unconvinced. One concern was that the mice without cilia on their node cells might have other defects as well, so that something other than the cilia themselves could be the cause of the left-right disturbances. Even Yale University pediatric cardiologist Martina Brueckner, who had been working with a different strain of mutant mice that also suffer a 50% chance of left-right reversal, had her doubts. "It just seemed so weird," she says.

But, at the meeting, she announced that her team has taken a close look at the node cells in their mutant embryos, too. They found that these cells do have cilia, but they stand rigid and straight, instead of twirling. Without that motion, evidently, the signal drifts randomly left or right, which could explain the reversals.

The observation boosts the theory that twirling cilia cause asymmetry, says cell biologist Chris Wright of Vanderbilt University. "Showing that they're rigid is tantalizing," he says. But to really clinch the case, he says, someone needs to show that the cilia in yet another mutant mouse strain called *inv*, in which almost all the animals have reversed organs, twirl backward.

–GRETCHEN VOGEL

SCIENTIFIC MISCONDUCT

EMF Researcher Made Up Data, ORI Says

In a blow to a research area hungry for credible findings, the federal Office of Research Integrity (ORI) reported last month that a biochemist "engaged in scientific misconduct ... by intentionally falsifying and fabricating data and claims" in two studies on how electromagnetic fields (EMFs)—the kind shed by power lines and home appliances—affect living cells. The researcher, Robert P. Liburdy, formerly of the Lawrence Berkeley National Laboratory (LBNL) in California, has agreed to ask the journals to retract the results. "There's a lot of acrimony in the [EMF] debate, and this won't calm things down," says Richard G. Stevens, a cancer epidemiologist at the Pacific Northwest National Laboratory in Hanford, Washington.

Liburdy's findings were among the first to offer a plausible mechanism for a possible link between EMF exposure and cancer or other diseases. In a pair of 1992 papers of which he is the sole author, Liburdy offered evidence that EMFs increase the flow of calcium into lymphocytes, a kind of immune cell produced in the thymus. The papers created a stir, as calcium ions signal cells to turn genes on and off, and play a role in cell division. Because tumor growth is tied to cell proliferation, an alteration in calcium signaling could conceivably lead to cancer. But in an analysis obtained by *Science*, ORI states that "Liburdy's claims that EMF causes cellular effects related to calcium signaling [in three figures in the two journal articles] are