funded by a number of ministries. For example, few citizens realize that the Tokai area is the only place the government even intends to try issuing a short-term warning, or how tenuous that effort is.

That public ignorance could prove costly to the program. Last year, after a tsunami claimed more than 200 lives following a magnitude 7.8 earthquake off the coast of Hokkaido, experts reluctantly appeared on television to explain that the region had few instruments and, therefore, that no warning was possible. An increasingly critical media has also bolstered Geller's campaign to open the program to greater public and scientific scrutiny; one small victory was the inclusion of scientists not directly involved in prediction research on a review panel reporting to the committee drafting the next 5-year prediction research plan.

Despite their participation, these outside reviewers remain unhappy about their influence on the plan, which went into effect on 1 April. "To a certain extent, I feel our suggestions were reflected in the seventh plan," says Fukao, "but there are areas I am very unsatisfied with." In particular, the new plan does not change how funds are divvied up, nor does it shift any money to new areas of research, especially at universities. Supporters respond that there's no need for major changes. "Basically, most of the research programs we see as being valuable are in the present plan," says Yoshimitsu Okada, a seismologist at the National Institute for Earth Science and Disaster Prevention and a vocal prediction supporter.

The sponsors of this month's symposium, the Science Council of Japan and the Seismological Society of Japan, would like it to lay the groundwork for a new "blueprint" for prediction research. But the most critics are expecting from the 2-day meeting is a public airing of their concerns. They note that already, newspapers and TV programs are giving them the rare opportunity to comment on official positions. Fukao also thinks that the outside reviews carried out at a few universities and research institutions of specific departments will spread eventually to prediction research. "Fundamental changes are coming," he says—a prediction that may be as difficult to pin down as the time and place of the next Tokai earthquake.

–Dennis Normile

Dennis Normile is a science writer based in Tokyo.

ELECTROMAGNETIC FIELDS

Breast Cancer Link Claimed, Criticized

The 15 June issue of the *Journal of the National Cancer Institute* contains an unusual pair of articles: An epidemiological study purporting to show a link between low-level electromagnetic fields (EMFs) and increased risk of breast cancer, and a commentary explaining why the research findings shouldn't be taken seriously. Welcome to the latest battle in the EMF wars.

The study, conducted by University of North Carolina (UNC) researchers, found that women working as electrical engineers or technicians, or as telephone installers, repairers, or line workers, seemed to have a 38% higher risk of dying of breast cancer than other workers. One of the researchers, David Savitz, calls the conclusion "tenuous" and "awfully tentative," saying it deserves attention only because breast cancer is such a common disease. But Dimitrios Trichopoulos, head of the department of epidemiology at the Harvard University School of Public Health, suggests in the commentary that the UNC data don't support even a tentative conclusion and notes that three other occupational studies have shown no link between EMFs and breast cancer in women.

> **"The interpretation should be infused with much more skepticism."**
> **—Ken Rothman**

The UNC researchers, Dana Loomis, Savitz, and Cande Ananth, identified 27,882 deaths from breast cancer in death records from 24 states. They then classified the women by occupation and compared the occupational histories of women who died of breast cancer with those of women who died of other causes. The researchers themselves note that the 38% risk increase they found among electrical workers is small, in epidemiologic terms, and the data it's based on may be unreliable. Only 68 of the breast-cancer deaths occurred among electrical workers. And as Loomis points out, "we only have information about people who are already dead."

Indeed, he says, they might not have considered their results worth publishing if not for the existence of a supporting biological hypothesis—a proposal that EMF exposure reduces production by the pineal gland of the hormone melatonin, which helps control cell growth. Suppressing melatonin, according to the hypothesis, increases the risk of sex hormone–related cancers. Also weighing in favor of publication, Loomis says, is the fact that four studies have linked EMF exposure to male breast cancer, a very rare disease.

In the accompanying commentary, however, Trichopoulos argues that the melatonin hypothesis is a poor rationale for publishing the results, since it is unproven and virtually untested. "The risk," he writes, "is that an unproven hypothesis may be invoked to support results generated from imperfect data, which, in turn, could be cited in support of the guiding hypothesis." He adds that although four studies have linked EMFs to male breast cancer, several dozen more have looked at EMFs and cancers of all types and reported no cases of male breast cancer at all.

More to the point, Trichopoulos writes, "at least six other studies have examined breast cancer in women in relation to EMF, and none has been reported as supporting a causal relation." Three of these, he notes, were occupational studies "of superior design" to the North Carolina study. Loomis and his colleagues, however, question the relevance of those studies because they were undertaken in Sweden and Denmark, where "occupational exposures and background patterns of breast cancer may be different than in the United States."

But Trichopoulos suggests it's more likely that something is amiss in the UNC group's study. Trichopoulos sees several "warning signs" in the results. Perhaps the most obvious shows up when the electrical jobs are classified as managerial and professional or manual. Women in the white-collar electrical jobs, such as electrical engineer, had a considerably higher rate of breast cancer than did women in the manual jobs—almost twice the rate of women in non-electrical occupations. Yet it's the women doing manual jobs like installing telephone lines, says Boston University epidemiologist Ken Rothman, editor of the journal *Epidemiology*, who would be expected to face the highest exposure levels.

Savitz says he "can't argue" with that criticism. Indeed, he and his colleagues point out another apparent contradiction themselves: They saw no excess of breast cancer in seven occupations that "also involved potentially elevated electrical exposures," including telephone operators and computer operators and programmers. Still, says Savitz, "there is probably not much more that can be done with the data to address [these] concerns."

Maybe not, says Rothman, but he thinks these patterns "detract from a causal interpretation." Given that the association is weak to begin with and past studies of breast cancer and EMFs have been negative, he adds, "the interpretation should be infused with much more skepticism."

–Gary Taubes