JAPAN

MITI Moves Into Basic Research

TOKYO—Long respected, even feared, by its international competitors as a driver of technology development, Japan's Ministry of International Trade and Industry (MITI) is about to try its hand at more basic research. The ministry announced last month that starting in April, it will launch a new program of research into areas of materials science, optics, and biology that are still far from commercialization. In support of its new venture, called the Leading Research Scheme, MITI plans to spend a total of some 300 million yen (around $2.4 million) per year and undertake some internal reorganization.

MITI won't be abandoning its traditional stock in trade—sponsoring government/industry consortia aimed at developing specific technologies. But as Japanese companies grow richer and more independent, they are less dependent on MITI's organizational and funding muscle, leaving the ministry looking for new ways to justify its existence. One answer—and a response to the growing international pressure for Japan to do its share of basic research—is for MITI to take responsibility for higher risk, interdisciplinary research.

The work will be performed mainly by institutes of MITI's Agency of Industrial Science and Technology (AIST), in cooperation with universities and the private sector. By uniting basic scientists from universities with researchers from industry and from the MITI institutes, the ministry hopes to create research consortia with a stronger academic and interdisciplinary flavor than in the past. MITI has chosen the following six research areas for its first foray into basic science:

- **Integrated inorganic materials.** By controlling the architecture of materials from the molecular level on up, researchers hope to produce composites and other inorganic materials with new levels of strength and toughness, as well as specialized properties like electrical conductivity.
- **Autonomous reaction materials.** These substances—complex molecules that change their shape in response to light, temperature, heat, or chemical stimuli—have caught investigators' fancy as possible drive mechanisms for artificial muscles and micromachines and as drug-delivery systems that would release medicine in response to body heat or to a change in the environment.
- **Exploiting tropical organisms.** The tropics host many unexplored life forms, such as soil microorganisms, that may harbor potential new drugs and other useful compounds. MITI researchers will screen organisms for promising compounds and develop techniques for modifying the compounds and producing them in bulk.
- **Biological evolution engineering.** By imitating the processes of biological evolution, MITI biotechnologists hope to produce new biomolecules with abilities not found in nature. One goal: enzymes that would operate at very high temperatures or in chemical environments hostile to the natural versions.
- **Femtosecond technology.** This line of research will pursue lasers and sensors that can operate on time scales of femtoseconds—thousand-trillionths of a second. Such devices are opening the way to dissecting chemical reactions and quantum phenomena and developing new high-speed communication devices.
- **Ecofactory technology.** The idea is to design factories (and their products) from the ground up to minimize pollution, waste, and energy use, rather than doing so after the fact by adding on pollution controls and recycling programs. MITI scientists will collaborate with private-sector researchers in the quest for these clean technologies.

All that is just the beginning for MITI's basic research venture. In 2 or 3 years, says AIST's Shoji Watanabe, MITI will review the projects; those that look particularly rewarding will be expanded and opened to broad international participation.

–Fred Myers

Fred Myers is a science writer in Tokyo.

FUSION

Princeton Lab Faces 9-Year Shutdown

After more than 40 years of flip-flop fortunes, the fusion researchers at the Princeton Plasma Physics Laboratory have learned how to roll with the punches. But they may soon be dealt a blow from which it will be hard to recover: If fusion funding does not increase next year—and there is no sign that it will—the Department of Energy (DOE) is planning to stop all fusion experiments at the Princeton lab in 1994. The lab would then be mothballed for at least 9 years while DOE invests in other fusion projects that it believes make a better next step for the program than anything Princeton has planned.

That strategy was outlined in a report released in late September by DOE's Fusion Energy Advisory Committee (FEAC), and it has begun to seem inevitable in recent weeks, following cuts Congress made in October to DOE's requested fusion budget. FEAC gave top priority to U.S. participation in the International Thermonuclear Experimental Reactor—an international effort to design a prototype fusion reactor—and completing deuterium-tritium experiments at Princeton's main current machine, the Tokamak Fusion Test Reactor (TFTR), by 1994. That would be the TFTR's last project: The experiments, which are intended to take the machine past the "break-even" point at which the reaction generates more energy than it consumes, have the unfortunate side effect of making the tokamak too radioactive to use.

If funding remains flat, FEAC recommended that Princeton put off building a new fusion reactor—the $500 million Tokamak Physics Experiment, which will develop technologies for future reactors—until at least 2003. FEAC also recommended that DOE shut the lab's only other running plasma experiment—the Princeton Beta Experiment-Modified—in 1994, the same year as TFTR. Combined, the measures would leave at least a 9-year window with no running experiments at all at Princeton.

In most fields, a half-decade's experimental hiatus would mean the death of a laboratory. But Princeton officials hope that fusion physics will be an exception. They're already investigating the possibility of distributing most of Princeton's 110 researchers to at least three other fusion laboratories—the Joint European Torus in the United Kingdom, the DIII-D tokamak at General Atomics Corp. in San Diego, and the Advanced Toroidal Facility at Oak Ridge National Laboratory, a machine that was mothballed this year after 3 years of operation but is scheduled for a restart in 1994.

Come 2003, Princeton hopes, most of the scientists would come back. "It's a risk," concedes Dale Meade, the deputy director of the Princeton lab, "because it's hard to predict our funding 9 years in the future." But he points out that such wholesale migrations of researchers are not unknown in physics, where scientists tend to gravitate to big machines, from particle accelerators to telescopes.

For the moment, the party line is to hope for better budgets. "Our strategy is to get good results from TFTR-DT and convince Congress to increase the budget," says Meade. But in Congress, enthusiasm for fusion has decidedly cooled. DOE requested a 7% increase to the fusion program in 1993, but Congress gave it $340 million—virtually the same as last year. President-elect Bill Clinton could change the picture, of course, but given budgetary pressures, no one is counting on a fusion renaissance anytime soon. Hope may spring eternal, but Princeton is planning for a shutdown all the same.

–Christopher Anderson