Japan Faces Big Task in Improving Basic Science

Structural changes as well as more money may be needed; university research system called "feudal"

Tokyo

THE JAPANESE love to gather statistics. But one set of figures in particular really bothers a lot of researchers here: U.S. scientists have won 142 Nobels, Japanese researchers have won 5.

In interviews with leading scientists and government officials, this disparity is brought up again and again. To many, the lack of Nobels symbolizes a multitude of weaknesses in the way basic research is conducted in Japan.

The need to strengthen the nation's basic research effort has recently become a common theme in pronouncements from many in government, academia, and industry. For decades, Japan has focused largely on applied research, an effort that has helped the country recover from the ruins of World War II to become the world's main creditor nation. Now the Japanese say that, with this new wealth, they are finally in a position to shore up their basic research.

Like their counterparts in the United States, Japanese leaders invoke economic arguments for improving basic research. Soichiro Ito, who was minister of the Science and Technology Agency until this year, said in an interview, "Science and technology is the driving force to be prosperous and successful."

But how best to go about this is the subject of considerable debate within Japan's science establishment. There is general agreement that more money for basic research is needed. But there is also a widespread recognition that some fundamental and painful changes may be required in the way research is funded and conducted.

Although Japan is similar to the United States in that basic research is supported chiefly by the government and is conducted mostly in universities and national laboratories, the research culture here is as different from American practices as kabuki is from break-dancing. Much of the government's research money is distributed according to seniority rather than merit, for example. This perpetuates mediocrity in basic research, several top Japanese scientists say, and it contributes to what one researcher describes as a "feudal system."

There is also relatively little movement of researchers from one lab to another, which tends to limit the flow of ideas and techniques among research groups. Many complain that Japanese education itself stifles creativity. And, unlike the situation in the United States, corporate contributions to academic laboratories in Japan and industry-university collaboration in research are relatively unusual.

Pressure for the government to step up spending on basic research has come not just from Japanese researchers but also from the U.S. Administration. Last year, during negotiations over the U.S.–Japanese science agreement, William Graham, President Reagan's science adviser, sought a commitment from the Japanese government to contribute more to the international pool of scientific knowledge, commensurate with Japan's new status as a world economic leader (*Science*, 31 July 1987, p. 476).

But this is no small challenge. Although Japan is flush with money, the government itself is running a significant—though declining—deficit. "It's strange. The economy is booming, but the government is poor," says Kenichi Matsubara, director of Osaka University's Institute for Molecular and Cellular Biology. The Ministry of Education, Science, and Culture, known as Monbusho, which controls almost half the government's total research and development expenditures, has in fact maintained a no-growth budget for years.

Marjorie Sun

Hiroshi Inose: *The small amount spent on individual projects is like "spraying water in the desert."*

Nevertheless, during the past decade, Japan's public and private sectors have actually doubled their expenditures on basic research, according to a recent report by the U.S. National Science Foundation.* Monbusho has managed to increase funding for basic research by trimming back other programs, for example. The report found that both countries put roughly the same share of their total R&D expenditures into basic research (some 12 to 13%), although it notes that actual comparisons are clouded by the fact that Japanese figures for basic research probably include some spending that would be classified as applied research in the United States.

There is, however, considerable dissatisfaction among some Japanese researchers with the way the money is being spent. Hiroshi Inose, one of Japan's leaders in science policy and director of the National Center for Science Information System, said in an interview that the increases in basic research supported by Monbusho and other agencies are largely being spent on big projects, particularly in high energy physics and space science. "If you exclude those big projects, what is left is very small," Inose says. "Projects typically get 1 million to 2 million yen [$8,000 to $16,000]. This is spraying water in the desert."

Even if the government budget for basic research were to expand substantially, the system that allocates it needs drastic revision, many top Japanese science leaders argue.

Monbusho distributes funds to researchers at national universities and laboratories through two main programs: a basic support system, in which money is allocated to individuals based on seniority alone, and grants, which are awarded on merit.

The basic support system was originally created to protect employees at the national universities and laboratories from political discrimination after World War II, at a time when socialism gained influence in Japan, according to Matsubara. The basic support system guarantees researchers a minimum level of income, based on seniority, to cover salaries, some research and overhead costs, and equipment purchases. This means that a professor at Tokyo University, one of the country's best institutions, receives the same research stipend from general funds and the same salary as one who has worked for the

*"The Science and Technology Resources of Japan: A Comparison with the United States" (Publ. 88–318, National Science Foundation, Washington, DC, 1988).

same amount of time at a much less prestigious school. The ministry spends more than twice as much on basic support as it does on grants, according to a Monbusho official.

Some researchers complain that the system keeps inferior scientists on the payroll. In the United States, Matsubara says, "unproductive scientists usually don't get money whereas here, they can survive." Yuji Hirayama, an economist at Shinshu University, offered a similar criticism in a Japanese newspaper last year: "In Japan, a scientist is virtually assured of tenure simply by landing a job. You can work hard or coast along at your own pace. No one really cares."

Inose says that before World War II, "Certain universities were centers of excellence. Now no one wants to say it, but after the war there was a democratization of education, which made everything uniform. So basic researchers were given the same amount of money regardless of affiliation. Seniority is important in this country."

Another serious problem is that Monbusho regulations make it virtually impossible to hire full-time secretaries and technicians. Even top researchers like Matsubara, who is one of the country's leading biologists, end up answering their own phones and doing much of the mundane lab work themselves. "It's a feudal system here," Matsubara says. "Young people can't survive because of the government structure. We can't hire secretaries and technicians. This kind of stupid regulation prevents us from improving basic science."

Matsubara says that the general fund system is under "hard attack" now. But the system does have some influential supporters. Michiyuki Uenohara, senior executive vice president and director of research at the Nippon Electric Corporation (NEC), says, "General funds are necessary. General funds are seed money for Japanese researchers."

Monbusho has responded to the critics by keeping the budget for general funds flat and increasing the money for grants for the past several years. For fiscal year 1989, which begins 1 April, the grants program will increase 6%, according to the new budget. Even so, this represents only about 13% of the total science and technology budget at Monbusho.

But the grants program also has its faults, according to Tasuku Honjo, a leading molecular biologist at Kyoto University, and others. They complain that the peer review system for choosing grant recipients is seriously flawed.

Monbusho has only a few peer review committees, each of which has just three members, who are recommended by scientific societies. Each referee is therefore responsible for scoring hundreds of applications. "The referees vote by mail. There is no discussion," Honjo says. "Peer review is in the hands of a small number of scientists. No one referee can know so much about so many fields."

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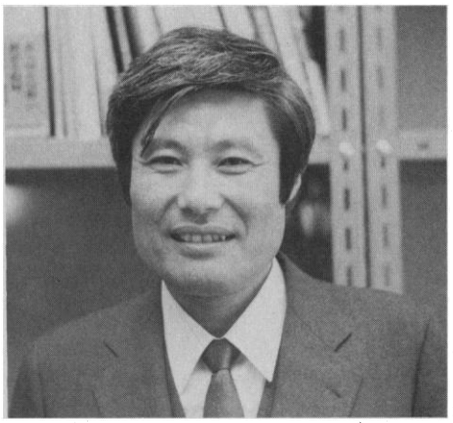
Tasuku Honjo: *The peer review system used by Monbusho is seriously flawed.*



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Fumio Kodama: *"Inbreeding is so dominant in our universities and it's getting worse."*

Honjo also complains that referees are usually "old persons, who, in general, don't know that much about new science, although there are exceptions. They're not active in bench science. It's almost impossible for an associate professor to be a reviewer." Researchers have also accused the peer reviewers of nepotism. Uenohara adds that peer reviewers and grant applicants are often intellectually conservative. Researchers and reviewers in Japan have a tendency "to copy what's been done in Europe or the U.S. If the work had not been done before, then the idea is discarded." He says that "the evaluation system has to be changed."

With Japan's economy booming, corporations would seem like a natural source of money for universities to tap for research funds. But, to prevent giving industry undue influence on campus, Monbusho rules purposely discourage corporate contributions to Japanese national institutions.

During World War II, university researchers in Japan were mobilized to help with the industrial military R&D effort. "The university was distorted by industry," says Fumio Kodama, director of the National Institute of Science and Technology Policy, a branch of the Science and Technology Agency. After the war and to this day, many Japanese researchers still regard industry money as "dirty money," says Inose, who has pushed for changes in Monbusho's rules. Honjo says that the government believes that "it's bad for a company to profit from a university relationship."

The government does allow companies tax credits for contributions to universities, but Monbusho rules discourage donations in another way. To contribute to a national university here, a company must first funnel the money to the ministry, which then puts it into its general budget. The money is eventually directed to the academic laboratory. Matsubara says, "It is difficult for corporate money to be quickly integrated into the university."

Paid consulting is virtually prohibited. In the United States, it is hard to find a top molecular biologist who does not have ties to a biotechnology company. But in Japan, "there are no official contracts among molecular biologists with companies," Honjo says. "We're not allowed to participate with companies under Monbusho rules. In practice, industry comes to me, but I don't get a consultation fee. The companies provide a small amount of money as a research donation."

In addition to institutional and budgetary constraints, Uenohara stresses another problem: "We have to increase money for basic research, but that's a secondary consideration. The primary goal should be how to motivate younger researchers." In the past, he says, "there's been a suppression of new ideas." In Japanese education, "the teacher is almighty. Japanese researchers are rather shy to express novel ideas. They incubate ideas until they are quite sure of them. We have to change that, especially in the primary school."

Kodama speculates that creativity is also repressed in part because there is very little mobility among faculty in Japanese universities. Kodama says, "Inbreeding is so dominant in our universities and it's getting worse."

Perhaps the biggest symbol to the Japanese that the government is trying to improve basic research is the establishment of the Human Frontiers Science Program, a pet project pushed by former Prime Minister Yasuhiro Nakasone and supported by his successor, Noboru Takeshita. The program, still rather nebulous in concept, is budgeted

for $19 million in fiscal year 1989 to set up the program's administration.

Many of the scientists interviewed emphasized the program's importance to basic science in Japan. Michio Okamoto, a member of the Council for Science and Technology, a panel that advises the Prime Minister's office on scientific matters, said in an interview, "There are three basic objectives to science and technology policy in this country: to strengthen basic research, to increase international cooperation, and to achieve harmony with human society and science and technology. The Human Frontiers Science Program will help achieve these three objectives. It represents a breakthrough to raise up basic research."

Japan has urged other nations to contribute money to the program. Okamoto and others say that a show of overseas financial support will help them convince the Finance Ministry to kick in more money. The United States has been cool to the idea while European countries support the program.

Researchers have no dearth of ideas for nurturing basic research here. Uenohara of NEC says, "We have to increase basic research in the corporate sector, but the government has a social responsibility to support basic research. If we could get 1% of the agricultural or forest subsidies, that would be significant. Monbusho has to act." Inose has long advocated that the government form an "Institute for Useless Research" to shake Japan loose from goal-oriented research.

Kodama says he used to believe that Monbusho should reorganize first and then increase the budget for basic research. Now, he is not so sure because that scenario seems politically unlikely. "Someone's individual budget would have to be cut" if Monbusho revamps first. "Where do we start? That's a problem. We have talked and talked about reorganizing for 10 years now and nothing has happened."

But, he says, "the prospect for change is better now. There is pressure from the United States and the world is paying more attention to our science."

■ MARJORIE SUN

The Drug Czar: No "Walter Wallflower"

"Several people have suggested that I should disassemble my bully pulpit, put on my green eyeshade, and just run numbers," said William J. Bennett, the former secretary of education who has been chosen by President Bush to be the drug czar, or chief of the new White House Office of National Drug Control Policy. At confirmation hearings before the Senate Judiciary Committee on 1 and 2 March, Bennett promised to shift to a low register but not to be silent.

Bennett, 45 years old, is known as a blunt speaker in a town of circumlocutors and as a defender of traditional methods of education. He holds an undergraduate degree from Williams College, a Ph.D. in philosophy from the University of Texas and a law degree from Harvard. He has spoken out on many topics not strictly within his purview, for example, defending witnesses in the Iran-Contra hearings, suggesting that metal detectors be used to keep weapons out of schools, and advocating mandatory AIDS testing.

Richard Bloom

William J. Bennett

A witness from a secondary school group, the Association for Supervision and Curriculum Development, described Bennett as a "combative and arrogant" administrator who "seemed to thrive on enhancing his own personal visibility." A Hispanic-American leader called the nominee "insensitive toward Hispanic educational concerns." They provided the only hostile public testimony.

A few senators warned Bennett that his new job will require more diplomacy. "You're not exactly Walter Wallflower," quipped Senator Alan Simpson (R–WY). It is hard enough to cope with interagency quarrels without emotional rhetoric, chairman Joseph Biden (D–DE) added. Bennett agreed, saying, "Politics is not a part of my beat in this job."

Biden and Bennett also seemed to agree on the role of the drug czar, created last fall in the Anti-Drug Abuse Act of 1988. Biden spoke of the fragmentation of the federal policy. Agencies have fought not only over bureaucratic turf, but literally drawn guns at one another in trying to make the same drug seizures. Biden mentioned a case in which one agency surreptitiously lifted another's budget by altering a computerized file.

The drug czar is supposed to bring such rivalries under control, to write a master plan for the government within 180 days, and to pass judgment on each agency's drug-fighting budget by certifying it as adequate or not. Thus, when Congress receives the next budget request from the White House, it will also get a critique from the drug czar. Bennett wanted to know whether he must certify each piece of an agency's budget (rather than each agency's total plan). Biden said he must. "That doesn't make life easier," Bennett replied, "but it makes it more interesting."

Bennett spoke of the need to express values, particularly in schools. He said that educational antidrug programs should involve not just academic courses, but should touch students directly, suggesting that principals should be willing to expel drug users. He claimed that schools with a tough expulsion policy actually have a lower expulsion rate. Bennett said, "We must let them know we are serious, that we mean what we say." It was to set an example himself, no doubt, that he gave up a 2-pack-a-day smoking habit a few weeks before the hearing.

The senators pressed Bennett to say how he would weight federal expenditures in the war on drugs, now balanced heavily (70%) in favor of enforcement. He put off answering until the comprehensive plan is due, about 6 months from now. He did say, however, that he saw regional differences in the patterns of abuse and that he may recommend trying a variety of approaches to enforcement, each to be evaluated for effectiveness. He also seemed reluctant to expand federal funding for treatment without a better understanding of "what works." Bennett said: "Most Americans think we should spend money on good treatment programs, if we can find them. The question is, do we have good treatment programs?"

■ ELIOT MARSHALL