ation requirements is vested in departmental committees. Introducing sweeping changes, Imura says, requires "a great deal of leadership" to build a consensus.

Even consensus is not enough, however, in negotiating with government bureaucrats. "Universities have very little discretion," says Tokyo's Yoshikawa. Budget allocations, the construction and use of new facilities, and many personnel decisions must all be negotiated with Monbusho; even tuitions and professors' salaries are fixed on a nationwide basis. For example, any attempt to develop a unique strength by hiring talent in one area and pruning faculty in another requires Monbusho approval, says Yoshikawa.

But even Monbusho doesn't have a free hand. Employment policy for all national employees, which includes national university professors, is determined by Japan's Management and Coordination Agency. And given the push to shrink public-sector payrolls to reduce the deficit, Murata says, "you'd likely soon get approval for the cuts but not the increases." Adds Imura, "I think universities should be given more freedom. But even Monbusho doesn't have the freedom it needs."

Indeed, the red tape is about the only thing that hasn't gotten better for universities in the past 4 years. But a more favorable environment for reform, an influx of resources, and a slew of new policies have given university officials a more powerful tool to slice through that still-formidable bureaucracy.

**–Dennis Normile**

REGIONAL UNIVERSITIES

# Schools Scramble for Niche To Keep Up With Competition

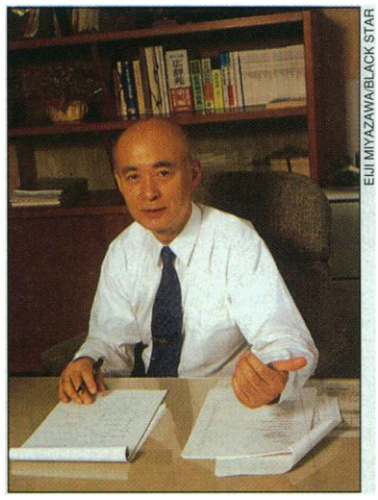
Faculty members at each one of Japan's 98 national universities get the same salaries, lab space, and base funding for research. At least they are supposed to, according to government policy. But some are more equal than others. The influence and prestige of the country's two oldest national universities, the University of Tokyo and Kyoto University, have allowed them to claim a disproportionate share of competitive government grants and big projects, and their faculty members enjoy the scientific perks that go along with such success.

That disparity began to diminish over the past decade, as talented researchers at less prestigious universities tapped into the large increases in funding for competitive grants. But the new push to expand graduate training and upgrade academic research to help underpin a stronger economy promises to have more ambiguous consequences for the academic research community.

To find out how the government's new policies are likely to change the topography of higher education in Japan, *Science* interviewed scores of administrators, faculty members, and students at national and private universities, including several with strong international reputations in one or more fields of science and engineering. Their answers suggest that the result could lead to greater parity among Tokyo, Kyoto, and the most active, large universities at the same time that it widens the gap between the top-tier and the less privileged universities.

A handful hope to carve out distinctive research and training niches to attract top students and faculty in a competition previously unknown on Japanese campuses. But others fear that their limited resources may be stretched even thinner as they are asked to do more. "The abilities of professors in smaller universities are by no means inferior," says Yahachi Saito, a physical chemist at Mie University in Tsu, 75 kilometers east of Osaka. "But the level of science in Japan will be lowered," he predicts, if the needs of such faculty members are not addressed.

What worries Saito and others is that the policy of equality espoused by the Ministry of Education, Science, Sports, and Culture (Monbusho) is a facade that hides its determination to strengthen a handful of the largest, most research-oriented universities. The rest would be relegated to producing a new breed of Ph.D.s for nonacademic careers. While all universities are encouraged to expand their Ph.D. programs, Naoki Murata, head of the ministry's university reform office, confirms that "the [ministry] research budget is distributed mainly to graduate schools and research centers that are very active." Each university, he adds, "must choose its direction."



EIJI MIYAZAWA/BLACK STAR

**Real reform.** Nagoya's Yamauchi hopes reorganization will give his graduate schools an edge.

However, observers say the playing field is not level. "If a university has a strong president, maybe it can pull itself up," says William Cummings, an authority on Japanese higher education at the State University of New York, Buffalo. "But the system is certainly weighted against them."

What galls many professors at second-tier national universities is that Monbusho has such tight control over the internal operations of individual universities that it can influence the outcome of the race. "If we can compete freely with other universities, that would be fine," says Katsumi Isono, a biologist at Kobe University. "But that requires financial and other types of autonomy that we don't have right now. If the city or provincial government wants to invest in our university so we could offer higher salaries or better facilities, they can't do it," he notes, because of rules governing faculty allocations.

Private universities, their financial situation already precarious, face an even worse situation. Although they are exempt from Monbusho's rules on salaries and hiring, they receive a smaller slice of competitive government grants. The drop in student-age population is cutting into their revenues from tuition—their main source of income—and a prolonged economic slump is hurting industry donations. The concept of overhead is still new: Waseda University, for example, only last year began adding 10% to industry grants and contract research to cover administrative costs. And private universities have not pursued royalties and licenses as a source of revenue.

Second-tier universities can't blame all their difficulties on external factors, however. One of their big problems stems from an overriding principle of academic life called *ji shu*, or self-government. Under that policy, for example, deans and presidents are elected by the faculty for limited terms and have little power to push through needed reforms. "It's even worse than it sounds," says a professor at the University of Tokyo. "None of the checks and balances at U.S. universities are in effect here."

**Repackaging science.** While most universities are scrambling to beef up their graduate programs, only a few seem to be attacking the task with gusto and originality. These tend to be large, competitive institutions with a critical mass of reform-minded faculty members and innovative leadership.

One such institution is Nagoya University, a major national university in central Japan with a strong reputation in science. Ranking a notch below the elites even has its advantages, says science dean Osamu Yamauchi. "We're more open-minded to new developments," he says.

Efforts to expand and improve graduate training have kept Yamauchi frantically busy over the past year. He is overseeing the reorganization of the School of Science, revamping the undergraduate and graduate curricula, and figuring out how to boost the number of graduate students. But he is not complaining. "We have more freedom to innovate now that Monbusho is encouraging reform," he says. "Five or 10 years ago, most professors here complained about Monbusho. But now we feel Monbusho is doing its best to support academic research."

One urgent task is to compete with Tokyo and Kyoto for promising applicants to fill the expanded graduate schools. Yamauchi hopes one lure will be the new Graduate School of Polymathematics, which aims to explore mathematical phenomena in such fields as engineering, medicine, social sciences, and humanities. "It's unique in Japan and probably in the world," he says. The idea came from members of the former mathematics department, which broke away from the School of Science to integrate its work into a broader range of fields.

Another selling point, Yamauchi hopes, will be the School of Science's four new divisions. The divisions were created out of the school's nine existing departments to promote interdisciplinary education. Graduate students interested in a frontier field such as cluster chemistry, for example, can now receive credit for courses in solid-state physics offered within the division of materials science. "Before, chemistry students couldn't take courses outside their department," says fullerene expert Hisanori Shinohara. "There was a high barrier between disciplines."

Another institution breaking new ground is Tokyo's Keio University, one of Japan's leading private universities, with strong programs in economics, medicine, computer science, and engineering. Although private universities in principle are free to set salaries, hire and fire faculty members, reorganize, and tap diverse funding sources, intrafaculty bickering and inertia can hamper needed reforms. Pay scales, for example, are fixed by seniority, making it hard to recruit "stars." A new department means a new staff, at major financial cost, because existing professors don't want to move. "In Japan, the power of a university president is not large," explains Yuichiro Anzai, dean of Keio's Faculty of Science and Technology. "Everything is determined by vote."

Since April, however, Keio has begun to restructure its undergraduate and graduate curricula. The first has been made more specialized, while the second has been broadened. Graduate students "will have greater freedom to choose from every branch of science," explains Koji Kaya, a Keio chemist who has been active in the reform effort, and courses will emphasize interdisciplinary, cutting-edge research in such areas as systems design and biological catalysis. Graduate students will also be encouraged to study in a department different from their undergraduate major. "Science and technology change so quickly, and we want students to be adaptable," Kaya says.

EIJI MIYAZAWA/BLACK STAR

**Pressed for time.** Jun-ichi Aihara's chemistry department at Shizuoka University has added graduate students without increasing its staff.

**A heavier load.** Universities trying to reinvent themselves must overcome limited resources, a lack of clout, and inertia. A physicist at Waseda, for example, worries that Monbusho will refuse to support efforts to strengthen his school's active science and engineering graduate schools because the university's undergraduate programs are so much larger. "Fifty percent of the students in the school of science and engineering are graduate students, but the university overall is mainly undergraduates, so we can't just change into a primarily graduate institution," he says.

Another problem for many science and engineering faculties at second-tier institutions is a heavier teaching load stemming from higher student-teacher ratios. Chemist Jun-ichi Aihara of Shizuoka University says that his department, despite being only a third the size of that at the University of Tokyo, accepts the same number—45—of graduate students every year. This year, Shizuoka established a new faculty of information sciences and a Ph.D. program at the Graduate School of Science and Technology without adding any staff. "At the present time, it is very difficult for us to save sufficient time for research," says Aihara. That lack of time also makes it harder to train new Ph.D. students.

Having smaller faculties also means less clout in the race for funding, says Hiromichi Hirano, chair of Waseda's earth science institute, who has reviewed Monbusho grants. "Big universities have many 'research friends'—graduates of their own departments [now at other institutions]—so they can make big teams. Members from different places each apply for major grants, which increases the chance that one of them will get it. But at Waseda, I can't produce so many Ph.D.s, so I can't make a big team. I have to get everything for my team by myself, like a small *yakuza* [organized crime] boss!"

Professors across the board also feel that Japan's grant-evaluation system is biased toward "big names" and the most prominent institutions. Chihiro Hamaguchi, a well-funded professor of electrical engineering at Osaka University, says too many applications read by too few reviewers means that "the established professors get the money." Others say that funding decisions would be fairer—and more useful—if referees had to explain them in writing. Monbusho took that approach this year in two classes of large grants, affecting some 300 applicants, but has not applied it to its routine grants-in-aid, with 90,000 applicants.

For better or worse, second-tier universities must figure out ways to be more competitive in education and research. In the past, universities filled their graduate schools with their own graduates. But now less prestigious schools face losing their best students to the elite institutions. "We are going to have to advertise," says Nagoya's Yamauchi—an idea foreign to most Japanese academics.

The government's policies seem likely to lead to greater competition and diversity among universities, but it is too soon to gauge how much. "It is almost impossible right now to make every university a research university," says Shinichi Yamamoto, an expert on Japanese higher education at the University of Tsukuba. But others say that further concentrating talent and resources is no guarantee of a stronger national research effort. Japan's major national universities are "already very large and yet have failed to produce many Nobel laureates," observes Aihara, a University of Tokyo graduate himself. "It is obvious that expanding their size does not mean raising the level of scientific research."

Not surprisingly, Aihara thinks the answer is to invest more in second-tier universities like his. Japanese science would be better served, he says, "by growing Shizuoka University and other universities of this rank as regional centers of scientific research."

**–June Kinoshita**

*With additional reporting by Dennis Normile.*