

benefit monetarily from the low-protein rice, covered by a patent held by the national laboratory that sponsored the collaboration. (The six participating companies can license the technology.) Tatsuji Chuman, general manager for technology planning at Japan Tobacco, says the company has no regrets about its participation, however. "We can learn from this experience," he says. "So it's not such a wasteful thing for us to do."

Indeed, some Japanese agbiotech firms are already applying their expertise to crops other than rice, where the market barriers are less intimidating. Companies like Suntory and Kirin Brewery, for example, have made a strategic move into floriculture. "We think flowers will gain public acceptance sooner than foods," says Takeshi Ohtani, manager of Kirin Brewery's Central Laboratory for Key Technology. Suntory is collaborating with the Australian firm Florigene to create a blue rose, and Kirin is manipulating chrysanthemums to resist cold and disease.

To prepare for the day when its bioengineered mums might become big business, Kirin purchased the Dutch flower company Fides, the world's largest producer of chry-

santhemums. "This alliance will give us a foothold in the global market," explains Ohtani. Also, he says, the technologies developed with mums "have a potential application in many plants." Japan Tobacco also has its sights set beyond Japan's borders. "We're developing cold-resistant corn, not just for within Japan, but for markets around the world," says Chuman. "Our thinking has been global from the start."

**Ripening interest.** All this activity suggests that, despite the hand wringing, Japanese agbiotech may yet blossom. One important factor is the government's grudging acceptance of rice imports. Last year's rice shock has also led to calls for reforming the 1942 law to lower trade barriers and shrink price supports that have benefited Japanese rice farmers for decades. Those changes could create more favorable market conditions for genetically engineered staple crops.

Japanese agbiotech companies are also closely watching U.S. public reaction to Calgene's Flavr Savr tomato, the genetically engineered squish-proof fruit that landed on U.S. supermarket shelves this past spring. Reports that the tomato is finding favor with

shoppers may prod companies into plowing more into R&D, some researchers suggest. "If Flavr Savr is popular," says a leading young plant scientist in Japan, "maybe we can be more optimistic."

Some experts outside Japan already are. "Here are 120 million people who can afford to spend a lot of money for food," says Ganesh Kishore, head of agbiotech research at Monsanto Corp. in St. Louis. "In Japan alone, rice is big enough for two or three major players. Japan also has the opportunity to be a very strong player in Asia," he asserts. "Because the Japanese are closer to Asia, they are more aware of what crops are consumed in that region—things that are not on our radar screen."

One sign that Japan could soon be a serious contender, says Kishore, is the rapid improvement in the quality of its basic research. "Where Japan lags is in discovering useful genes," he predicts. "But I think that's likely to change over the next 3 to 5 years. For Japan, national prestige and economy are at stake. I don't think they'll walk away from this technology."

—June Kinoshita

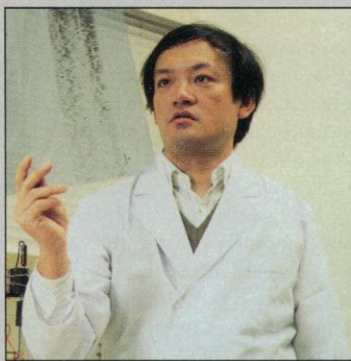
## PROFILE

### Biologist on the Fas(t) Track

When Shigekazu Nagata is not working in his lab at the Osaka Bioscience Institute (OBI), he can often be found cruising the open road in his espresso-colored Toyota Sprinter. "I like to drive very fast," he impishly admits. Nagata's love of speed carries over into his science. For the past several years, he and his OBI co-workers have raced into print every few months with pathbreaking papers that have attracted the notice of researchers around the world working on cellular signaling proteins called cytokines. "He is really fast," says James Wells of Genentech, who has collaborated with Nagata. "You don't want to end up competing with Shiggy."

Nagata, age 45, has the disheveled air and energy level of a man half his age. Bounding around his lab, he explains his latest experiments on the fas antigen and its receptor—a system that appears to play a primary role in apoptosis, or programmed cell death. His earnest expression often breaks into grins of delight, as though he feels extremely lucky to be doing what he's doing. His publication record, however, suggests that luck has little to do with his achievements. More likely, his success derives from his keen nose for important problems, his tenacity, and his willingness to take risks. Also, as one close friend remarks, "He's very nice, very modest—and he's very competitive."

Nagata took his first big leap in 1977 by taking his newly minted Ph.D. in biochemistry from the University of Tokyo Institute of Medicine to the Swiss laboratory of University of Zurich professor Charles Weissmann. His goal was to learn the then-new recombinant DNA technology. "I thought this must be so powerful," he explains, "but at the time no one at Tokyo was



**Highly cited.** Shigekazu Nagata of the Osaka Bioscience Institute.

doing it." Nagata proved an able student. In 1980, he beat out formidable competitors, including Genentech's David Goeddel, in the race to clone the human interferon gene.

Two years later, Nagata was back at the University of Tokyo as a research associate in the lab of Yoshito Kaziro, where he proceeded to isolate and clone granulocyte colony-stimulating factor (G-CSF). Unlike many young Japanese scientists, who often toil anonymously under a senior professor, "I could do what I wanted," he recalls, "perhaps because Dr. Kaziro is so kind."

Still, that wasn't the same as running his own show. In 1987, when OBI asked him to head its molecular biology department, he

jumped at the chance. With typical understatement, he describes his decision to leave the prestige and security of Tokyo as "a nice challenge." OBI was then a small, brand-new research center, funded by the city of Osaka and local companies and without precedent in Japan. Once there, Nagata quickly discovered that building a department from scratch consumed much of his time. "Recruiting the staff to come to a new institute was hard," recalls a colleague. "He had to train them himself."

But having assembled his team, a dozen people in their 20s and early 30s, Nagata has never looked back. Unencumbered by academic hierarchies and administrative chores, the lab has made seminal contributions to the understanding of the G-CSF and fas systems. And mindful of how the Japanese system assigns minor roles to young scientists, Nagata tries to give his protégés plenty of leeway. "They are all independent," he says matter-of-factly. And like their mentor, they enjoy going at top speed.

—J.K.