FRENCH SCIENCE

Storming the Bastille

Several new programs are helping young scientists achieve unprecedented levels of independence in France—although revolutionary change in the "mandarin system" of powerful lab chiefs may be a long way off

GIF-SUR-YVETTE, FRANCE—Renaud Legouis has had an enviable career for a researcher only 34 years old. As a student in developmental biology at the Pasteur Institute in Paris in the early 1990s, he helped identify the gene for Kallmann syndrome, a rare and enigmatic disease characterized by a failure to enter puberty and by a loss of the sense of smell. Shortly after receiving his Ph.D. in 1994, he was snapped up by the biomedical research agency INSERM, which awarded him a permanent job. The position allowed him to join any lab that would have him. Legouis spent three more years at Pasteur before moving on to the Institute of Genetics and Molecular and Cellular Biology (IGBMC) near Strasbourg, one of France's most prestigious research centers. There he joined a team studying the genetics of the tiny worm *Caenorhabditis elegans*, a model organism for development.

Legouis could have spent the rest of his career at IGBMC, which is run by one of the most powerful and best-known figures in French science, Pierre Chambon (*Science*, 29 September 1995, p. 1814). But last fall, thanks to a grant program that helps young scientists achieve independence, Legouis seized a rare opportunity to venture out and stake his own claim to fame. The $100,000 grant is allowing him to set up a *C. elegans* lab at the Center for Molecular Genetics here in Gif-sur-Yvette, near Paris. "Not everyone who has a permanent position wants autonomy and to lead a research group," Legouis says. "But for me it seemed the logical step."

Legouis is one of a growing band of young scientists now gaining autonomy in France's hierarchical, and sometimes hidebound, research community. In contrast to countries such as the United States and United Kingdom, where young scientists are expected to lead teams early on, French research has long been dominated by a "mandarinate": a quasi-feudal hierarchy that concentrates funds and vests power in a relatively small number of lab and institute chiefs. Although the mandarinate's strength varies from discipline to discipline, it remains especially ingrained in the life sciences.

Some mandarins, including Chambon, have earned reputations for encouraging independent research by young scientists in their labs while still holding onto the purse strings. But overall, the mandarin system is increasingly seen as a harness that reins in young talent. "The mandarin creates a machine where everyone has their role to play and where everyone takes their place," says Marc Haenlin of the Center for Developmental Biology in Toulouse.

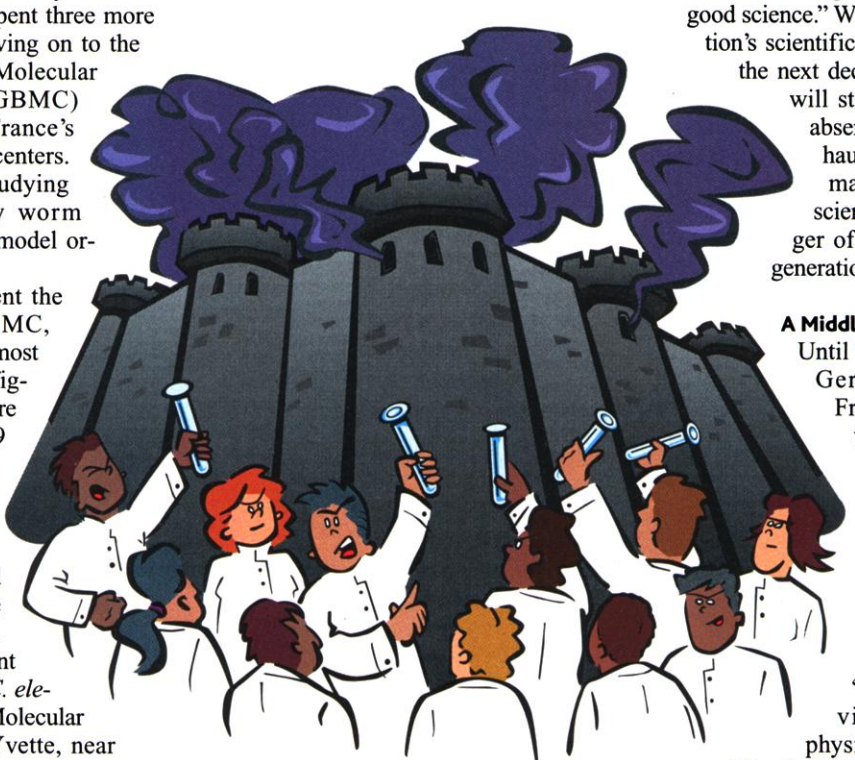


ILLUSTRATION BY TIM SMITH

But the mandarin system is now under assault—and if not crumbling, it's at least fraying. French officials have launched a series of initiatives that give promising young scientists their own funds and lab space. "There has been an evolution" toward opening up opportunities for young researchers, says Geneviève Berger, director-general of the basic research agency CNRS. The stakes are high: Many observers here worry that their stodgy scientific system puts French research at a competitive disadvantage with that of other nations, particularly the United States. At a press conference last fall, for example, research minister Roger-Gérard Schwartzenberg complained that the obstacles to young scientists were forcing them to leave France for jobs elsewhere. "France's role is not to serve as a training institute of young doctorates for the benefit of the United States or other countries," he remarked.

Most researchers who spoke to *Science* agree that the programs that target young scientists are working well, at least for the chosen few. Still, they say, it is too early to know whether the creation of *jeunes équipes*, or "young teams," will bring fundamental change to France's scientific community. "The mandarins are not an endangered species," says Richard D'Ari, a molecular microbiologist at the Jacques Monod Institute in Paris. "But interstices have opened up in which some young researchers manage to find niches and do good science." With almost half of the nation's scientific force due to retire over the next decade, senior-level niches will steadily open. But in the absence of a thorough overhaul of the French system, many fear, these budding scientific leaders are in danger of maturing into the next generation of mandarins.

A Middle Ages feel

Until World War II, when the German occupation of France and its aftermath threw many of the nation's institutions into upheaval, the power of mandarins was nearly absolute. "We had a very medieval system" in which prominent scientists behaved like "princes, counts, and viscounts," says geophysicist Vincent Courtillot of the Institute of the Physics of the Globe in Paris. The past half-century has seen "a democratization," he says, particularly in the physical sciences.

According to Berger, the need to share accelerators and other large-scale facilities has loosened many a lab director's grip on money and influence. On the other hand, she notes, the mandarins still rule many life science roosts, and they have received the majority of government science funding in recent years. Although estimates vary, about 50 mandarins hold court in fundamental life sciences research, but the number may be several times higher in applied

medical science.

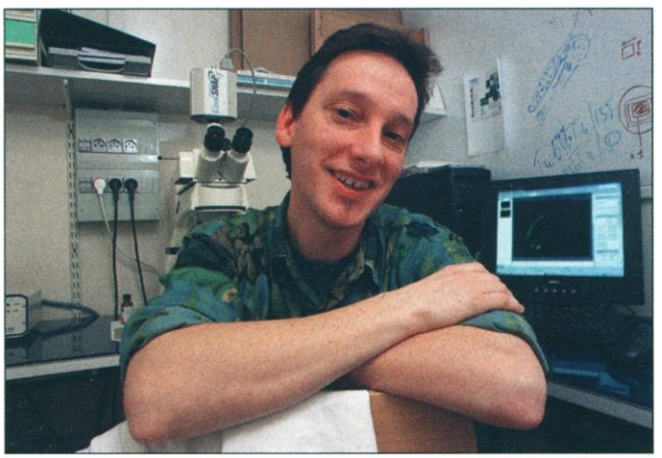
Many young life scientists who have tasted independence in other countries find it difficult to return to the French system. "In the United States, I was really treated as a scientist the moment I walked into the lab and not as a laborer," says Maryse Bailly, a French cell biologist at the Institute of Ophthalmology in London. Bailly, who received her Ph.D. from the University of Lyons before spending 7 years as a postdoc at the Albert Einstein College of Medicine in New York City, laments that "in France you are completely dependent on the head of your unit." Even young researchers with permanent jobs "are often nothing more than senior postdocs," Bailly adds, a major reason for her decision to work in London. "Here I have my own lab and do my own research, and no one tells me who to hire or what kind of tissue culture flask I have to buy."

Alarmed by an accelerating brain drain, the late Claude Paoletti—then director of CNRS's life sciences department, one of the most powerful posts in French science—created a program in 1990 called ATIPE to try to lure back expatriate talent and persuade those with wanderlust to stay put. ATIPE provided about $100,000 (since raised to an average of $120,000) over a 3-year period, along with guaranteed lab space, to researchers whose proposed projects passed scientific muster. "You arrive at an institute with all the prerogatives in place, theoretically able to resist all the mandarins in the world," says Haenlin, whose ATIPE grant, awarded in 1997 when he was 38 years old, allowed him to set up shop in Toulouse.

To ensure that lab directors did not use the ATIPE program to recruit underlings, Paoletti required grantees to move to a new institute. "This mobility clause has been more important than anything else in [helping break down] the mandarin system," says American molecular geneticist Linda Sperling, a senior CNRS researcher at the Center for Molecular Genetics in Gif-sur-Yvette. "It breaks the pattern of powerful scientists building up an empire of people who are beholden to them."

The assault on the mandarins strengthened considerably after Claude Allègre, a geochemist, became research minister in 1997. At Allègre's direction, Courtillot, the ministry's former research director, put together a task force to create its own initiative for young researchers. Unlike ATIPE, ACI does not require a researcher to change institutes, and many ACI recipients have chosen to form "subgroups" within an already existing laboratory. But in some ways ACI grants may be more empowering: They allow a recipient to use up to half the money to hire staff. Such flexibility is not permitted ATIPE grantees, who must depend on the generosity of institute directors to provide them with postdocs or technicians. Some researchers have found the hiring power essential to creating a young team.

"This is a real change," says molecular biologist Didier Trouche of the Institute of Cell Biology and Genetics in Toulouse, who was among the first ACI grantees in 1999. "This is the only French grant that allows me to choose which postdoc I hire"—a privilege traditionally reserved for the mandarins.



CREDIT: REMI BENALI/GAMMA

Independence days. Renoud Legouis used a young-scientist grant to set up his own *Caenorhabditis elegans* lab near Paris.

Since its inception, ACI has provided nearly $25 million in grants to 281 young scientists across the sciences. At the Laboratory of Dynamic Oceanography and Climatology in Paris, for example, Marina Lévy—also a member of the 1999 crop—used her $55,000 grant to form a subgroup within the 100-researcher strong institute. Even though she chose to stay put rather than set up shop elsewhere, the money allowed her to hire a postdoc and buy computers to strike out in a new research direction—modeling the relation between phytoplankton growth cycles and ocean currents. "My ACI allowed me to develop a new scientific theme and to get new results rapidly," Lévy says.

Inspired by the success of ATIPE and ACI—and prodded by Allègre and his successor, Schwartzenberg—CNRS has since expanded ATIPE to all eight of its science departments. And INSERM has just launched its own program—Avenir, or "future"—which resembles ACI and is expected to fund about 45 young researchers this year.

Plus ça change?

Although the raft of programs is generating success stories, most observers are wary about predicting the imminent downfall of the life sciences mandarins. The number of young scientists benefiting from the grants is "relatively limited," Berger says, "so we must be careful about saying that it is leading to a profound or radical change." Thus, although CNRS is spending nearly $6 million a year on ATIPE, the 565 grant winners since 1998 are still a minority of the roughly 3000 CNRS scientists currently under 40, the age limit for receiving them. The pool of potential grantees also includes non-CNRS scientists at other agencies or in universities who are working in a CNRS lab.

Nevertheless, Courtillot insists, the programs may wield considerable impact as the years go by: "It may not seem like much in terms of percentages now. But if we produce 300 top scientists now, those will be the seeds that will make a big difference for the future. We will know in the next 5 years."

Much will depend on what happens to individual young teams once the nurturing funds run out and they must grow on their own. ATIPE and ACI grants last only 3 years. After an award is up, says Haenlin, "you must integrate into the system." Ultimately, the price of freedom is the daily struggle that many scientists elsewhere face: raising research funds. Most French public agencies provide 30% or less of a lab's running costs, and scientists must turn to biomedical charities or industry for the rest. "When you are recruited to the CNRS, you get a salary and little else," says Trouche.

Indeed, some observers worry that the programs may put too much pressure on young researchers. "This is a bad interpretation of the American model," contends Henri-Edouard Audier, a chemist at the École Polytechnique in Palaiseau. "Rather than integrate young scientists progressively into the laboratories, we are isolating them." Few scientists in France yearn for a wholesale adoption of the U.S. model. "In the U.S. it's sink or swim, and every scientist is an island," says Stuart Gilder, an American geologist who has worked at the Institute of the Physics of the Globe for the past 7 years. "Here in France, we don't have islands, we have scientific communities."

Legouis, whose ACI grant gave him his independence, agrees that France should not seek to emulate the "very harsh" U.S. system. In France, he says, "some people don't want the stress and the responsibility of being team leaders but just want to do good science. There is still enough flexibility in the system to make this possible." Indeed, adds Sperling, "this is the charm of the French system: that there is a middle road."

–MICHAEL BALTER