

FRENCH RESEARCH IN TRANSITION

More funding, more autonomy and a new administrative system: over the past three years, French scientific research has undergone massive reforms. From the establishment of the National Research Agency (*Agence Nationale de la Recherche*, ANR) in February 2005 to new laws on research and university autonomy passed in April 2006 and August 2007, France is now on a road to modernization which aims both to simplify and rejuvenate what President Nicolas Sarkozy described last March as “an old moth-eaten system (*un vieux statut mité*).” **By Michel Leroy, Laurent Passicouset, and Julie Clayton**

Until now, research in France has been divided among five different types of organizations: universities, elite higher education institutions (the *grandes écoles*), national research agencies such as the National Center for Scientific Research (*Centre National de la Recherche Scientifique*, CNRS), foundations such as the Pasteur Institute, and private labs. The reforms are shaking up research mainly in the public system, to enhance collaboration and international competitiveness, pay structures, and recruitment of foreign scientists.

Among the 360,000 researchers in France today, 55 percent work for the private sector, mainly in four industrial fields: electronics, engineering, computer services, and pharmaceuticals. The public sector, meanwhile, struggles to attract the best new researchers, competing both with the private sector and with international labs. To make matters worse, most of the alumni from the science and engineering *grandes écoles* do not move on to graduate training, preferring management positions in industry to a research career. And research priorities are different, as public funding focuses on life sciences, social sciences, math/physics/chemistry, and space exploration.

More Collaboration, More Funding

One of the most significant measures of the French reforms is the law called Freedom and Responsibilities of the Universities (also known as the Autonomization Law), which was adopted three months after Sarkozy's election. This gives university presidents more freedom to recruit staff, manage their assets and budgets, create partnerships with industry, and look for additional funding from private companies.

A key goal of this and other reforms is to enhance collaboration between different players, including with industry, even though 90 percent of the CNRS's 1,200 departments are already joint bodies, or units, comprising university and research agency laboratories.

Public-private partnership is also encouraged as a way to attract both new funding and industry collaboration, inspired by the so-called American R&D model of a more industry-oriented approach.

“We need to be clear,” says **G rard Posa**, director general of the newly established Lyon 1 University Foundation. “France's culture does not allow us to be copycats of the American system. Nevertheless, we have chosen the closest model we could, with clear aims and ways to achieve them: a system that works like industry does.”

Eighteen years ago, Posa established, alongside Lyon 1, a commercial body called Ezus. Ezus brings together leading chemical and biopharmaceutical companies to invest in applied research in this city, France's second **continued »**



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—Jacques Berger



largest. The venture has doubled its turnover in the past five years to €14 million (\$20.2 million), and has filed several dozen patents. According to Posa, “The aim of a foundation is to work as a facilitator on a noncommercial basis. Our strength is to be on the ground. We know intimately each department and each laboratory of our university—and thus their potential.”

Despite Lyon 1 University moving slowly initially, the collaboration with Ezus has paved the way for cultural change, creating a far closer relationship and collaboration with industry.

Other institutes have followed the trend, such as the National Institute for Agricultural Research (*Institut National de la Recherche Agronomique*, INRA), which enjoyed a turnover of €8.2 million (\$11.8 million) in 2007 and an 8 percent rise from the previous year in industry-funded research.

Competitiveness

Under the 2007 law, French universities can establish foundations for receiving donations. The foundations can then determine which research projects, facilities, or positions they wish to support, including the appointment of new chairs and the provision of competitive salaries to attract prominent researchers. “A survey identified foreign research workers who would be interested in coming to Lyon,” Posa says. “Within the next year, at least two or three new chairs will be established to welcome them.”

One of the Lyon-based investors is vaccine manufacturer Sanofi Pasteur, whose president, **Jacques Berger**, sees many benefits to the changes: “There’s no rivalry between those who want to work in state-funded research and those who want to work in the private sector,” he says. As a result, Berger has witnessed closer cooperation between university and industry researchers, particularly in areas where university researchers excel.

In the awarding of their funding, the foundations, like the universities, are giving priority to global competitiveness clusters identified by the government in 2005. The LyonBioPole is one of these, dedicated to virology, immunology, and diagnostics.

In mid July, the ministry selected all but one of the 10 campuses that will be revamped with such a global perspective in mind. These constitute the pilot group of a €5 billion (\$7.2 billion) renovation plan, achieved through the amalgamation of universities. The universities, rather than the ministry, decide upon their involvement—an illustration of their new autonomy. For the first time, the French egalitarian system has been abandoned: the project encompasses just 39 out of the 83 existing universities.

The first nine pilot campuses are in Bordeaux, Grenoble, Lyon,

Montpellier, Strasbourg, Toulouse, Aubervilliers, Aix-Marseille, and Saclay, the last being a huge and frequently postponed project, once described as a French MIT, 20 km south of Paris. The tenth, somewhere in central Paris, will be announced in November. This list also illustrates another aspect of the French reforms—a greater devolution of power to the regions. The regions seeing the highest investment are Ile-de-France (Paris), Rhône-Alpes (Lyon, Grenoble) and Aquitaine (Bordeaux). Trailing behind are Auvergne (Clermont-Ferrand) and Alsace (Strasbourg).

Not everyone is convinced, however, that the changes will lead to better results. An American astrophysicist, **David A. Smith**, moved to France 15 years ago after a stopover in Pisa, Italy. He now works for the Nuclear Studies Center (*Centre d’Etudes Nucléaires*) in the southwest city of Bordeaux, in a CNRS laboratory.

“In the USA, everybody cooperates and exchanges. This is part of a long-lasting tradition. Here in France, everything is fragmented,” he laments. “I support the desire to make people work together, but administrative grouping does not automatically lead to collaborative groups of people.”

Many in the scientific community point out that they did not wait for the latest reforms before applying for funds and developing collaborative projects. “Despite having some deficit in applied science, some projects already exist,” says **Jean Esterle**, a professor at Bordeaux 1 University. “Last January, we launched a research study with the National Institute for Research in Computer Science and Control (*Institut National de Recherche en Informatique et en Automatique*, INRIA), together with the neighboring Pau University and various partners including the oil company, Total.”

Furthermore, France was the third largest beneficiary of the European Union’s 6th Framework Programme for Research and Technological Development, winning a 13 percent share of the overall sum available, i.e., €2.17 billion (\$3.13 billion). This has helped enhance the country’s ability to compete in the international arena and attract foreign talent.

According to Esterle, the scientific community in Bordeaux is already internationalized. “We have among our permanent staff mathematicians from Germany, Russia, Bulgaria, the United States, China, and Iran.”

Nationally, 20 percent of the Ph.D. candidates come from outside the European Union. But the number of foreign postdoctoral scientists is dramatically lower. To redress this, the 2008 state budget has increased by 10 percent the funds aimed specifically at allowing universities to attract postdocs.

The new trend toward increasing employment of scientists from abroad is already evident in the universities, where 10 percent of newly appointed associate professors and 15 percent of full professors now come from abroad.

Attracting Talent

A major attraction for foreign researchers is that the French national research agencies and universities employ researchers on permanent civil service contracts. “Probably the most crucial step at the beginning of a career is to secure civil servant status,” says Smith of the Nuclear Studies Center. “It gives peace of mind and the ability to concentrate on one’s research.”

One research center that is actively recruiting foreign scientists—into biology, ecology, environmental science, and other areas—is INRA, where around 25 percent of candidates for permanent positions are foreigners. INRA is Europe's largest agricultural research center, or rather collection of centers located throughout France. Civil servant salaries are given to those in permanent positions, while overheads are provided for those on short-term contracts. Individual research units seek grants from various sources, including ANR, the EU, private companies, and government ministries. To add to the international flavor, most of the French researchers hired into permanent positions have worked abroad, according to **Thierry Boujard** of INRA's human resources department. "It's really important that our researchers think international, and have an international network."

Two years ago INRA also launched a new scheme of providing four-year contracts to foreign researchers who propose their own program of study, with salaries that are higher than those for civil servants. They are then expected to move on to positions elsewhere, but stay part of a collaborative network. "We expect that it will open collaborations for much more than the four years," says Boujard. The institute also takes special steps to help newcomers settle in, organizing accommodation and social security, and providing intensive French language courses.

Starting Out

A prevailing concern in France is the difficulty that early career scientists have in achieving independence in a hierarchical system dominated by experienced heads of labs and departments, particularly in the universities. Most scientists starting out join an existing lab, rather than running their own as is common in

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the United States and United Kingdom. This is where private foundation-based research centers such as the Paris-based Institut Curie have an advantage, according to director **Daniel Louvard**. On the flip side, French scientists start their career earlier than their US or UK counterparts, due in part to the extended post-doctoral training required in the latter countries.

Institut Curie combines a research center and hospital focusing on the diagnosis and treatment of cancer, and specializing in breast and gynecologic cancers, and pediatric tumors. Its ranks will soon swell from 900 to over 1,000 people with the opening of a new Department of Developmental Biology in October. Six teams are already in place, and the recruitment drive is under way to complete the teams for the opening. Louvard is aiming to hire mostly junior investigators. "We want to stimulate research by giving a chance to young investigators starting either from an existing small group or from scratch, i.e., just finishing their first or second postdoc."

Louvard is also imposing limits on team size. "We want to avoid the formation of big empires and stimulate the interactions between these groups—there's an incentive to collaborate because you're not big enough." In this way, Louvard believes the institute will gain most from its mix of research disciplines and potential for translational research, involving anything from theoretical physics and pharmacology through cell biology and radiobiology to imaging and bioinformatics.

The public system is still "too complicated, too centralized, and too slow," Louvard asserts. In contrast, "Our attractiveness is our ability to react quickly, to be adaptable," including for the employment of foreign researchers. "A postdoc candidate can send me a CV at any time during the year, and **continued** »

Featured Participants

Bordeaux 1 University
www.u-bordeaux1.fr (in French)

Ezus
www.ezus-lyon.fr (in French)

Institut Curie
www.curie.fr/index.cfm/lang/_gb.htm

Le Havre University
www.univ-lehavre.fr/internat

Lyon 1 University Foundation
www.lyon1fondation.org (in French)

National Center for Scientific Research (Centre National de la Recherche Scientifique, CNRS)
www.cnrs.fr/index.html

National Institute for Agricultural Research (Institut National de Recherche Agronomique, INRA)
www.international.inra.fr

National Institute for Health and Medical Research (Institut National de la Santé et de la Recherche Médicale, INSERM)
www.inserm.fr/en/index.html

National Institute for Research in Computer Science and Control (Institut National de Recherche en Informatique et en Automatique, INRIA)
www.inria.fr/index.en.html

National Research Agency (Agence Nationale de la Recherche, ANR)
www.agence-nationale-recherche.fr/Intl

Nuclear Studies Center (Centre d'Etudes Nucléaires de Bordeaux Grandignan, CENBG)
www.cenbg.in2p3.fr (in French)

Sanofi Pasteur
www.sanofipasteur.com

Young Researchers Confederation (Confédération des Jeunes Chercheurs, CJC)
cjc.jeunes-chercheurs.org (in French)

Focus on France

within two weeks I can say yes or no—granting the possibility of bringing that person in the next day and guaranteeing a 12-month salary equivalent to a Marie Curie Fellowship.” He is also providing up to 30 percent extra in salary to scientists who do additional activities such as teaching, training, and interacting with clinicians or with industry.

It is perhaps a testament to this flexibility that the institute has had over 500 postdocs in the past five years, representing almost 50 nationalities, “which makes good lab parties where everybody brings the traditional food of their countries,” laughs Louvard. Joking aside, he believes that it is this level of international recruitment that has enabled the institute to achieve “real visibility in biomedical research.”

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—Morgane Gorria



Retaining Talent

Meanwhile, at the national research agencies, some relatively recent initiatives are giving promising early career researchers their own funds and lab space, to foster their independence.

A 35-year-old specialist in molecular biology, **Fabrice Lejeune**, benefits from an *Avenir* grant from the National Institute for Health and Medical Research (*Institut National de la Santé et de la Recherche Médicale*, INSERM). Over five years Lejeune, a newly tenured scientist, gets €60,000 (\$86,400) a year to pay for one postdoctoral fellow and to buy research equipment for the joint INSERM-Pasteur Institute unit in Lille, in northern France where he works. “But I still have to apply for additional funding from the ANR, and to patients’ associations like the French Muscular Dystrophy Association,” Lejeune explains.

Through the *Avenir* initiative—a program started in 2001 but the effects of which are only now being felt—INSERM awards 20 grants to tenured early career scientists and 20 to nontenured ones. The competition is tough and applicants must have demonstrated academic excellence and capacity for autonomous research.

Lejeune did his Ph.D. in one of France’s leading research centers, the Institute of Genetics and Molecular and Cellular Biology (IGBMC), near Strasbourg, eastern France. Following a three year postdoc at the University of Rochester in the United States with professor Lynn Marquat, Lejeune was recruited by INSERM in 2005.

“I chose to come back to France in spite of the salary gap,” Lejeune explains. “After three years as a permanent researcher, I have now reached the same salary I had in the United States at the end of my postdoc. This question of low salaries remains difficult even now with my *Avenir* program. I have hired a postdoc from Poland who has to accept the job for a gross salary

of €20,400 [around \$29,400] a year instead of \$40,000 in the States where living costs are lower.” And even if Lejeune gets more funding for a postdoc, he will still have to follow the same salary scale at INSERM.

Fair Compensation

The salary issue remains a challenge in France, and is even more sensitive for people just starting on the academic ladder. The *Confédération des Jeunes Chercheurs* (Young Researchers’ Confederation, CJC), an umbrella organization of 35 scientists’ associations, proposes that Ph.D. candidates should be recognized more as professionals rather than regarded simply as students.

“We are demanding a true doctoral contract, a three-year job contract,” says its president, **Morgane Gorria**, an agronomist who has a Ph.D. in biology and currently works as a nontenured assistant professor in Le Havre University in northwestern France. “It is a funding issue and also a way to be recognized by one’s peers.”

Until now there has been no single type of contract for a Ph.D.—candidates entering doctoral programs must apply for an *allocation de recherche* (research allowance): a monthly salary of around €1,658.25 (about \$2,400) paid by the government for up to three years.

Another approach is to join industry through a *Convention Industrielle de Formation par la Recherche* (CIFRE), a private contract partly funded by the government, but which is negotiated with the employer. The average yearly salary is €24,800 (\$35,700). Despite the announcement of an increasing number of private-funded contracts, those in the CIFRE program remain in the minority: there are currently 70,400 Ph.D. candidates in France, but only 15,000 contracts have resulted from the launch of the CIFRE program since 1981.

The most common type of funding, however, is the *libéralités* which consist of grants from various bodies and universities, but do not include the benefits of a pension or medical insurance that would be provided by a contract. These are supposed to have been phased out (from 2004 onward), but they still exist for many researchers. The most controversial issue, however, is the change in rules on how scientists are recruited and assessed. According to the new law, universities will have the power to recruit researchers and professors on a short-term basis, although the proportion is still unknown. Moreover, the recruitment procedure has been changed to fight a long-denounced systemic favoritism. From this September, the first universities will implement the new rule that 50 percent of any ad hoc recruitment committee must comprise external members—another key step in a new era for science careers in France.

France’s road to modernization of research may not be smooth, and it may be a while before the new funding and autonomy of the universities leads to greater international competitiveness, but it is clear among the scientific community that a shake-up was sorely needed in the old system. Now at least, the reforms do appear to be taking French science in the right direction.

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