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Health and Medical Research in France

Observatory on Health Research Systems

Emmanuel Hassan

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This documented briefing provides an overview of the health and medical research system in France. The report is part of a series of country-specific reports from RAND Europe’s Observatory on Health Research Systems, funded by the Department of Health (England).

The report is divided into three parts. In the first part, ‘Structure of the French health research system’, funding sources, sectors performing health and medical research and health research priority setting are presented. The second part, ‘Processes and performance of the French health research system’, focuses on the types of funding available and how funding activities are conducted, and provides exemplars of the system’s performance. The third part, ‘Outlook’, considers current and emerging health research issues in France.

The report is based on desk-based document review and will be updated on a regular basis. It does not attempt to discuss current policy options or make recommendations for future strategy. The report will be of interest to government officials dealing with health and medical research policy, medical research councils, health and medical research charities, public and private institutions engaged in health research and researchers.

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Summary

Summary: key points

- The governance of the French health and medical research system is complex due to the high number of institutions involved in:
  - the definition of the main strategies of the French health and medical research system;
  - the implementation of these main strategies in scientific priorities and R&D programmes;
  - health-related research activity.
- The scientific performance of the French health and medical research system shows signs of weakness because:
  - its scientific contribution to the world stock of knowledge is declining;
  - its scientific output lacks visibility at the world level.
- Several recent evaluation reports have called for a reform of the French health and medical research system, notably to:
  - better define the responsibilities of institutions in strategic planning;
  - improve the programmatic decision process;
  - strengthen research in universities and university hospitals.

This documented briefing gives an overview of the French health and medical research system. It provides an account of the main decision-making, executive and research bodies within the system. It also examines various aspects of process and performance, including the funding of public biomedical research, execution of R&D expenditure by the different public research institutions, the stock of biomedical researchers in the public sector and scientific output in medical research and related research fields.

The analysis of the French health and medical research system shows a complex structure due to the high number of institutions involved and their multiple roles. Three main categories of institutions can be distinguished according to their functional role in the system.

- **Decision-making bodies.** Many institutions – including several ministries, regional and local authorities as well as public research institutes – contribute to the definition of the main strategies of the health and medical research system and to the allocation of R&D budgets to achieve its mission.

- **Executive bodies.** Numerous institutions – including ministries, funding agencies, public health agencies, foundations and public research institutes – participate in the implementation of the main strategies of the health and medical research system in scientific priorities and R&D programmes.
• **Research bodies.** Both academic and mission-oriented institutions are involved in biomedical research, ranging from universities (including university hospitals) to public research institutes and foundations.

Examination of various aspects of the process and performance of the French health and medical system reveals the following.

• **R&D funding.** In 2003, R&D spending on public biomedical research amounted to €2,737.9 million, which represents around 20 per cent of the national R&D effort on public research. The higher education sector and public research institutes constitute the bulk of funding in public biomedical research, thanks to the general grants that they receive from ministries such as the Ministry of Higher Education and Research, Ministry of Health, Youth and Sport and other public authorities.

• **R&D performance.** Public biomedical research is conducted predominantly in academic institutions, including universities (excluding university hospitals) and the National Centre for Scientific Research (Centre National de la Recherche Scientifique; CNRS). Despite its critical mission in the health and medical research system, the National Institute of Health and Medical Research (Institut National de la Santé et de la Recherche Médicale; Inserm) performs only about 15 per cent of total public biomedical research. Moreover, university hospitals only execute a small share of public biomedical R&D, although they are the key players in clinical and translational research.

• **Researchers.** In 2005, 10,677 researchers (full-time equivalent) were involved in public biomedical research, representing 22 per cent of the stock of researchers in the public research sector. More than two-thirds of the researchers work in universities (including university hospitals) and at CNRS.

• **Scientific output.** French scientific output in medical research and related research fields such as fundamental biology shows weaknesses compared to other large European countries, and lacks visibility at the global level. Part of these weaknesses can be explained by the low scientific performance of universities (including university hospitals) in these research fields compared to public research institutes, including Inserm and the Atomic Energy Commission (Commissariat à l’Energie Atomique; CEA), as well as foundations such as the Institut Pasteur (Pasteur Institute).

The French health and medical research system has been evaluated by different agencies and committees. The conclusions from these reports underline the extreme complexity of the governance of the system which may hamper its scientific performance, and suggest government initiatives to reform the system.
**List of abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AERES</td>
<td>National Agency for the Evaluation of Research and Higher Education (Agence d’Évaluation de la Recherche et de l’Enseignement Supérieur)</td>
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<tr>
<td>ANR</td>
<td>National Research Agency (Agence Nationale de la Recherche)</td>
</tr>
<tr>
<td>ANRS</td>
<td>National Agency for AIDS Research (Agence Nationale de Recherche sur le SIDA et les Hépatites Virales)</td>
</tr>
<tr>
<td>CHU</td>
<td>University Hospital (Centre Hospitalier Universitaire)</td>
</tr>
<tr>
<td>CHR</td>
<td>Regional Hospital (Centre Hospitalier Régional)</td>
</tr>
<tr>
<td>CEA</td>
<td>Atomic Energy Commission (Commissariat à l’Energie Atomique)</td>
</tr>
<tr>
<td>CLCC</td>
<td>Centres for the Fight Against Cancer (Centres de Lutte Contre le Cancer)</td>
</tr>
<tr>
<td>CNRS</td>
<td>National Centre for Scientific Research (Centre National de la Recherche Scientifique)</td>
</tr>
<tr>
<td>INRA</td>
<td>National Institute for Agricultural Research (Institut National de la Recherche Agronomique)</td>
</tr>
<tr>
<td>Inserm</td>
<td>National Institute of Health and Medical Research (Institut National de la Santé et de la Recherche Médicale)</td>
</tr>
<tr>
<td>IRD</td>
<td>Research Institute for Development (Institut de Recherche pour le Développement)</td>
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</table>
This documented briefing aims to give an overview of the French health and medical research system. The first section gives an overview of the main decision-making, executive and research bodies within the health and medical research fields. In the second section, the analysis focuses on the process and performance of the French health and medical research system by examining patterns in research and development (R&D) funding for public research in these fields, the stock of researchers involved in public medical research and their allocation among the main research bodies and its scientific performance. The briefing concludes by providing an overview of ongoing discussions at policy level on the future of French health and medical research.
### Structure of the French health research system

#### Overview of the main bodies of the French health research system

<table>
<thead>
<tr>
<th>Decision-making bodies</th>
<th>Executive bodies</th>
<th>Research bodies</th>
</tr>
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<tbody>
<tr>
<td>- Central government</td>
<td>- Higher education sector</td>
<td></td>
</tr>
<tr>
<td>- Regional and local government</td>
<td>- Funding and public health agencies</td>
<td></td>
</tr>
<tr>
<td>- European Commission</td>
<td>- Foundations</td>
<td></td>
</tr>
<tr>
<td>- Public research institutes</td>
<td>- Public research institutes</td>
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</tbody>
</table>

The French health and medical research system is diverse, involving many institutions from three different institutional sectors: government, higher education and private nonprofit. This section gives a brief overview of these institutions, classifying them according to their functional role in the system (Esterle et al., 2008).

Several institutional bodies participate in the definition of the main strategies of the system and the allocation of R&D budgets to achieve its mission.

The main decision-making bodies lie with central government. Several ministries take part in the definition of the main strategies of the system. These ministries include, notably, the Ministry of Higher Education and Research and Ministry of Health, Youth and Sport. Other ministries such as the Ministry of Economy, Industry and Employment, Ministry of Foreign Affairs, Ministry of Defence and Ministry of Food, Agriculture and Fisheries also play decision-making roles, although they are less important.
Main decision-making bodies

- Several institutional bodies contribute to define the main strategies of the health and medical research system and the allocation of R&D budgets to achieve its mission:
  - central government
  - regional and local government
  - European Commission
  - large public research institutes

Apart from central government, regional authorities also contribute to the definition of the strategies of the system. The European Commission influences the decisions of the national bodies, principally through its major research funding instrument, the European Union (EU) Framework Programmes for Research and Technological Development. These programmes have been the main financial instruments through which the EU supports R&D activities, particularly through cross-country scientific collaborations, in almost all scientific disciplines. The Seventh Research Framework Programme (2007–2013) has earmarked a total of €6,100 million for funding health research.

Large public research institutes such as the National Institute of Health and Medical Research (Institut National de la Santé et de la Recherche Médicale; Inserm) and the National Centre for Scientific Research (Centre National de la Recherche Scientifique; CNRS) play a *de facto* role in the definition of the main strategies of the French health and medical research system, given the size of their R&D programmes and activity in these fields. It is worthwhile mentioning that the role of public research institutions as decision-making bodies may increase in the near future, with the newly-formed National Alliance for Life and Health Sciences (Alliance Nationale pour les Sciences de la Vie et de la Santé). Created under the initiative of the central government, the Alliance comprises the main key research institutions in France:

1 However, some of agencies think that such an alliance is ineffective in defining the main strategies of the system and has no role in advising the Ministry of Higher Education and Research and Ministry of Health, Youth and Sports (Agence d’Evaluation de la Recherche et de l’Enseignement Supérieur (AERES), 2008).
- Inserm;
- CNRS;
- Atomic Energy Commission (Commissariat à l'Énergie Atomique; CEA);
- National Institute for Agricultural Research (Institut National de la Recherche Agronomique; INRA);
- National Institute for Research in Computer Science and Control (Institut National de Recherche en Informatique et Automatique);
- Research Institute for Development (Institut de Recherche pour le Développement; IRD);
- Pasteur Institute (Institut Pasteur); and
- Conference of University Presidents (Conférence des Présidents d’Universités).

Its objective is to improve the governance of French health and medical research through better coordination among decision-making, executive and research bodies in the definition of the main strategies of the system and their implementation in R&D programmes.
Main executive bodies

- Implementing the main strategies of the health and medical research system in scientific priorities and R&D programmes is the responsibility of many executive bodies:
  - central government
  - funding agencies
  - public health agencies
  - foundations
  - large public research institutes

Several executives participate in implementing the main strategies of the French health and medical research system into scientific priorities and R&D programmes. These bodies include, notably:

- central government;
- funding agencies;
- public health agencies;
- foundations; and
- large public research institutes.
Executive bodies: central government

- Not only are central government bodies involved in strategic planning, but they also intervene in the programmatic decision process.
- Among these bodies, the Ministry of Health, Youth and Sport plays an important role in implementing the main strategies of the health and medical research system through its Hospital Programme for Clinical Research.
- Created in 1992, this programme funds clinical research in public institutions (e.g., university hospitals and the Centres for the Fight Against Cancer) through calls for proposals.

Not only does central government play a role in the definition of these strategies, but it also participates directly in their implementation through R&D programmes. For example, the Ministry of Health, Youth and Sport intervenes at this stage through its Hospital Programme for Clinical Research (Programme Hospitalier de Recherche Clinique). Created in 1992, the Programme funds clinical research in public health institutions (e.g., university hospitals and the Centres for the Fight Against Cancer – Centres de Lutte Contre le Cancer; CLCC) through national and interregional calls for proposals.

National calls for proposals are divided into two categories. The first corresponds with calls for proposals related to a number of selected priorities of the Hospital Programme for Clinical Research. In 2009, these priorities were:

- Alzheimer’s disease;
- cancer;
- mental health;
- autism;
- infectious diseases;
- paediatrics;
- chronic diseases;
- rare diseases; and
- palliative treatments.
The second is dedicated to investigator-initiated research. The priorities of the interregional calls for proposals are defined at the regional level by the Interregional Commissions for Clinical Research (Délégations Interrégionales à la Recherche Clinique).
Executive bodies: funding agencies

- Several public funding agencies participate in the programmatic decision process
- While the missions of some agencies go beyond the scope of health and medical research, other agencies have missions that target only specific scientific priorities in these fields
- The main funding agencies include:
  - the National Research Agency
  - the National Agency for AIDS Research
  - the Institute for Public Health Research

Many funding agencies participate in implementing the main strategies of the system. These main agencies include the following.

- **National Research Agency (Agence Nationale de la Recherche; ANR).** Established in 2007, ANR is a public agency under the authority of the Ministry of Higher Education and Research which funds research projects, on a competitive basis, in several thematic research areas, including health and medical research. In 2008, ANR had a total available budget of approximately €900 million for research projects in all thematic areas. In 2008, approximately 80 employees worked at the agency.

- **National Agency for AIDS Research (Agence Nationale de Recherche sur le SIDA et les Hépatites Virales; ANRS).** Created in 1992, ANRS coordinates research on AIDS and viral hepatitis B and C. It funds research projects, mainly on a competitive basis, on basic biological research, vaccination, clinical and epidemiological trials, public health research and social and human sciences. The agency conducts its funding mission with the support of the ministries responsible for research, health and foreign affairs and the main French research organisations: Inserm, CNRS, the Pasteur Institute and IRD.

- **Institute for Public Health Research (Institut de Recherche en Santé Publique).** This institute was created from the Virtual Institute for Research in Public Health (Institut Virtuel de Recherche en Santé Publique). The latter was established in 2004, on Inserm’s initiative, in the form of a collaborative agreement with the different institutions involved in public health research,
including the Ministry of Higher Education and Research and Ministry of Health, Youth and Sport. In 2008, the Institute integrated one of eight of Inserm’s thematic institutes, namely its own mission, which is to promote French research in public health. Its aims are to: define a scientific policy for public health research; develop a policy for collective management of tools; and set up activities to help with decision-making and providing expertise. Since 2008, the institute has funded research projects on public health in collaboration with other public institutions involved in public health research, such as the National Institute for Public Health Surveillance (Institut National de Veille Sanitaire) and ANR.
Executive bodies: public health agencies

- Agencies influence implementation of the main strategies of the health and medical research system
- Large public health agencies include:
  - the National Institute for Public Health Surveillance
  - the National Cancer Institute
  - the French Food Agency
  - the National Institute for Prevention and Health Education

Alongside funding agencies, public health agencies influence implementation of the main strategies of French health and medical research. These agencies include the following.

- **National Institute for Public Health Surveillance.** Created in 1998, this governmental institution falls under the authority of the Ministry of Health, Youth and Sport. It is responsible for surveillance in all domains of public health: infectious diseases, effects of the environment on health, workplace risks, chronic diseases and injuries and international and tropical diseases.

- **National Cancer Institute (Institut National du Cancer).** This Institute was established in 2004, under the French Cancer Plan, to enable a long-lasting, coordinated national policy against cancer. Placed under the joint authority of the Ministry of Higher Education and Research and the Ministry of Health, Youth and Sport, it brings together all of the main players involved in the fight against cancer in France. The Institute funds projects and innovative initiatives in the fields of research, care, prevention, screening and patient support.

- **French Food Agency (Agence Française de la Sécurité Sanitaire des Produits Alimentaires).** Created in 1999, the Agency is a public health agency falling under the authority of the Ministry of Food, Agriculture and Fisheries and the Ministry of Health, Youth and Sport. Its mission is to protect and improve public health, animal health and welfare and environmental health by providing surveillance and monitoring activities, evaluating health and nutritional risks and benefits and recommending health protection measures.
• National Institute for Prevention and Health Education (Institut National de Prévention et d’Éducation pour la Santé). Created in 2002, this public institute falls under the authority of the Ministry of Health, Youth and Sport. The Institute has the following missions: to implement public health programmes on behalf of the government and its public bodies; to provide expertise and consultancy in matters of prevention and health promotion; to ensure the development of health education throughout the entire French territory; and to participate in the management of emergency or exceptional situations which have consequences for the general population’s health – notably, in broadcasting health warnings during emergency situations.
Executive bodies: foundations

- Foundations support health and medical research
- Like agencies, the missions of a number of foundations are not restricted to health and medical research
- These foundations include, notably:
  - the Foundation of France
  - the Cancer Research Association
  - the French Muscular Dystrophy Association

Numerous foundations contribute to implementing the main strategies of the system as defined by the decision-making bodies. Like agencies, the missions of a number of foundations such as the Foundation of France (Fondation de France) are not restricted to health and medical research. However, other foundations such as the French Muscular Dystrophy Association (Association Française contre les Myopathies) only target specific areas in health and medical research. Examples of the main foundations in the system are given below.

- **Foundation of France.** Created in 1969, the Foundation supports the growth of all forms of private philanthropy. In particular, it enables individuals or companies to create their own foundation under its aegis and to benefit from its advice on management. The Foundation is active in all the fields of public interest: national and international solidarity, health and medical research, culture and the environment. Projects supported by the Foundation in the fields of health and medical research concern research on cancer, cardiovascular disease, Parkinson’s disease, ophthalmology, neuro-ophthalmology and autism. The Foundation employs approximately 130 full-time people, and approximately 430 volunteers also work for it.

- **Cancer Research Association (Association pour la Recherche sur le Cancer).** The Association has funded research on cancer through calls for proposals for 40 years through the support of private donors. It allocates different kinds of funds: individual grants to young researchers; grants to support research projects essential to the emergence of new research themes; and funds for scientific laboratory equipment in the context of the Association’s regional policy.
• **French Muscular Dystrophy Association.** Created in 1958 by a group of patients and their families and recognised as being of public utility in 1976, the Association has two missions: to cure neuromuscular diseases, and reduce the disabilities that they cause. In order to achieve its missions, the Association finances research projects, mostly on a competitive basis.
Executive bodies: large public research institutes

- Some public research institutions are involved in the programmatic decision progress since they are also responsible for funding research
- These institutions are large public research institutions, in particular:
  - Inserm
  - the National Centre for Scientific Research

Public research institutes are involved in implementing the main strategies of health and medical research in scientific priorities and R&D programmes. Among these institutes, Inserm and CNRS play a key role.

- **Inserm.** Created in 1964, Inserm is a public institution with a scientific and technical vocation under the joint authority of the Ministry of Health, Youth and Sport and Ministry of Higher Education and Research. It is the only French public research institute dedicated entirely to human health. Its researchers are committed to investigating all diseases through their research in the fields of biology, medicine and public health. Its principal mission is to facilitate exchange between basic research, clinical research, therapeutic or diagnostic research and public health research. In order to fulfil this mission, the institute works in partnership with other public or private research institutions, including hospitals. Of Inserm’s 316 research laboratories, 80 per cent are housed in university hospitals or CLCC, with the others located on CNRS research campuses the Pasteur Institute and Curie Institute (Institut Curie). Approximately 13,000 people, including 6,000 researchers, work in these research laboratories. Inserm employs approximately 8,000 staff.

- **CNRS.** Established in 1939, CNRS is a government-funded research organisation under the authority of the Ministry of Higher Education and Research. As the largest research organisation in Europe, CNRS carries out fundamental research in all scientific and technological fields, including life and health sciences. The centre’s annual budget represents one-quarter of French public spending on civilian research. Its funding comes from the government, other public funding...
sources and its own funds, primarily from industrial and EU research contracts and royalties on patents, licences and services provided. It employs more than 32,000 people. Approximately 90 per cent of its research units work in partnership with higher education institutions and other public research institutes.
Health and medical research in France is performed by the higher education sector, public research institutions and foundations. The organisation of research in French health and medical research is complex due to the variety of institutions involved and the interrelations between them. Research involves both mission-oriented and academic (i.e. non-mission-oriented) institutions. Moreover, French health and medical research is characterised by the presence of many joint research units under the legal authority of different entities. Both academic and mission-oriented institutions are part of the higher education sector.

- **Universities.** With the faculties of medicine, these are the principal actors of health and medical research in France. There are approximately 40 faculties of medicine in France. Universities carry out research in health and medical research but also in other health-related fields, such as fundamental biology.

- **University hospitals (CHU).** Created in 1958 in France to retain leading academics and practitioners, CHU are hospitals or other public healthcare institutions which have a legal partnership agreement with one or several universities. A number of employees are both practitioners and academics. The hospitals have a threefold mission of care, training and research, and their research mission focuses mainly on transnational and clinical research. There are 29 CHU in France.

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2 In this document, data on university hospitals also include CHR (regional hospitals). There are only three CHR in France.
• **CLCC.** Officially established in 1945, CLCC are private non-profit institutions financed by national health insurance and are under the authority of the Ministry of Health, Youth and Sport. Their mission is to fight against cancer through prevention, screening, care, education and research. There are 20 CLCC in France.

Several public research institutes perform research in the fields of health and medical research. The missions of these institutes go often beyond health and medical research. In addition to Inserm and CNRS, the main public research institutes involved in health and medical research are as follows.

• **INRA.** Created in 1946, INRA is a government-funded agricultural research institute under the joint authority of the Ministry of Higher Education and Research and Ministry of Health, Youth and Sport. As the largest agricultural research institute in Europe, INRA carries out mission-oriented research for high-quality and healthy foods, competitive and sustainable agriculture and a preserved and valorised environment. INRA has 218 research units, including 141 joint research units associated with other public research institutes or higher education institutions. The bulk of its budget comes from the two ministries. It employs more than 8,500 staff.

• **CEA.** Established in 1945, CEA is a public technological research institute under the joint authorities of many ministries including, among others, the Ministry of Higher Education and Research, Ministry of Economy, Industry and Employment and Ministry of Defence. It is active in three main fields: energy, information and health technologies, and defence and national security. CEA has around 65 joint research units with the higher education sector and other public research institutes. More than half of its civilian budget is funded by the government; the remaining part of its civilian budget comes mostly from external sources, namely partner companies and the European Commission. Its military budget is mainly financed by the Ministry of Defence. It employs approximately 15,000 people.

• **IRD.** Created in 1944, IRD is a public research institute under the joint authority of the Ministry of Higher Education and Research and Ministry of Foreign Affairs. IRD has four main missions: research, expertise, training and scientific information. It conducts scientific programmes contributing to the sustainable development of the countries of the South. The institute has three scientific departments, including one devoted to health and its relationship to society. IRD has 78 research units, of which 38 per cent are joint research units with higher education institutions and other public research institutes. It employs more than 2,200 people.

Foundations are the third main research actor of the French health and medical research system. The main foundations are as follows.

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3 Although CLCC are private non-profit institutions, they are classified in this briefing as higher education institutions because they provide higher education.
• **Pasteur Institute.** Created in 1887, the Pasteur Institute is a private, non-profit foundation that contributes to the prevention and treatment of disease through research, education and public health activities. Its research on biology gives priority to the fight against infectious diseases: viral (e.g. hepatitis, AIDS, rabies, poliomyelitis and haemorrhagic fever); bacterial (e.g. tuberculosis, whooping cough, meningitis, cholera and diarrhoea); and parasitic (e.g. malaria). In terms of education, every year approximately 250 young scientists from all over the world follow high-level courses in microbiology and immunology, and more than 800 trainees from 60 different countries come to improve their knowledge and skills at the Institute’s laboratories. The Institute’s public health activities concentrate on the following services: vaccination (e.g. influenza, tetanus, hepatitis and diphtheria); advice to travellers (on infectious and tropical diseases, travel medicine, allergy, rabies centre); a screening centre (AIDS, hepatitis C); and an analysis laboratory. Its budget comes from three main sources: revenues generated from its activities, government contributions and donations. Its campus in Paris comprises almost 2,800 people.

• **Curie Institute.** Created in 1909, the Curie Institute is a centre of excellence for childhood cancers. Its organisation is based on the ‘Curie model’: a close interface between cutting-edge basic research and innovative and quality healthcare. This model rests on a research centre, a department of transfer and a hospital. The Institute’s research centre is one of the largest in Europe, and the largest in France dedicated to oncology: it is made up of more than 60 research teams associated with CNRS, Inserm and universities. The department of transfer acts as a bridge between basic research and care in order to allow patients to benefit more quickly from scientific findings. It develops diagnostic techniques and new therapeutic approaches. The hospital is a private institution acting as a public hospital service: about half of its research budget is financed by the Ministry of Higher Education and Research, Inserm and CNRS; its other sources of research funding are the revenues from its activities and donations. The Curie Institute employs 2,200 staff, of which 850 are associated with the research centre.
Process and performance of the French health research system

Funding of public biomedical research

- In 2003, biomedical R&D performed by the public research sector amounted to €2,737.9 million, representing around 20 per cent of the national R&D effort on public research
- Public research institutes and the higher education sector constitute the bulk of funding in public biomedical research

<table>
<thead>
<tr>
<th>Institutional bodies</th>
<th>€ million (2003)</th>
<th>% Total</th>
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<tbody>
<tr>
<td>Administration</td>
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<tr>
<td>National</td>
<td>116.7</td>
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<td>Regional/local</td>
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<td>National agencies</td>
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<td>Foundations</td>
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<td>EU Framework Programme</td>
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<td>France</td>
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<td>Abroad</td>
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<td>Abroad</td>
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<tr>
<td>Total</td>
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<td>100</td>
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</table>

Source: Esterle et al. (2008)

This section focuses on the process and performance of French health and medical research by examining patterns in public R&D funding, the stock of researchers involved in public biomedical research and the scientific performance of its main institutions.

In 2003, biomedical R&D performed by the public research sector in France accounted for €2,737.9 million – about 20 per cent of total R&D performed by public research institutions. Public biomedical R&D in France is funded mainly by the main research institutions through general grants received from ministries such as the Ministry of Higher Education and Research and other public authorities.

In 2003, almost 40 per cent of public biomedical R&D was funded by the higher education sector – universities, CHU-CHR (university hospitals and regional hospitals) and CLCC. Compared to universities, CHU-CHR and CLCC fund only a small share of

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4 Official data on biomedical R&D funding and performance are not available in France. The data presented in this section are based on the estimates calculated by Esterle et al. (2008), based on the results of the French survey on R&D expenditure. Biomedical R&D performed by foundations such as the Pasteur Institute is considered in the document to be public R&D, due to its strong connection with the biomedical R&D carried out by higher education institutions and public research institutes.
public biomedical R&D. R&D financed by universities was approximately €948.5 million in 2003, representing approximately 90 per cent of financing from the higher education sector.

In addition, public research institutes are a major funder of public biomedical R&D. In 2003, their financial contribution was similar to that of the higher education sector. Among the research institutes, CNRS and Inserm fund the largest share of public R&D biomedical research: in 2003, CNRS funded 500.4 million, and with €370 million, Inserm’s funding was fewer than 15 per cent of the total. The funds from each of the main remaining public research institutes − INRA, CEA and IRD − did not exceed €100 million.

With €137.9 million in 2003, the Pasteur Institute funded the largest share of public biomedical R&D among the foundations.

Although the statistics presented above show the small financial contribution of agencies to public biomedical R&D, they do not take into account the recent creation of agencies such as ANR and the Interregional Commission for Clinical Research (National Institute of Cancer). Funding, mainly through calls for proposals, is likely to have increased from these types of agencies since 2003. Their financial contribution in public biomedical R&D is estimated to be around 10 per cent in 2006 (Esterle et al., 2008).
Performance of public biomedical research

- Public biomedical research is performed predominantly in academic institutions, including universities (excluding university hospitals) and the National Centre for Scientific Research
- Despite its critical mission, Inserm performs only a small share of public biomedical R&D
- University hospitals (CHU) only execute a small share of public biomedical research while they are key players in clinical and translational research

<table>
<thead>
<tr>
<th>Institutional bodies</th>
<th>€ million (2003)</th>
<th>% Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic institutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universities</td>
<td>1,160.5</td>
<td>42.4</td>
</tr>
<tr>
<td>CNRS</td>
<td>517.0</td>
<td>18.9</td>
</tr>
<tr>
<td>Inserm</td>
<td>424.4</td>
<td>15.5</td>
</tr>
<tr>
<td>INRA</td>
<td>104.7</td>
<td>3.8</td>
</tr>
<tr>
<td>CEA</td>
<td>96.5</td>
<td>3.5</td>
</tr>
<tr>
<td>IRD</td>
<td>19.3</td>
<td>0.7</td>
</tr>
<tr>
<td>CLCC</td>
<td>97.9</td>
<td>3.6</td>
</tr>
<tr>
<td>CHU-CHR</td>
<td>91.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Other public research institutes</td>
<td>13.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Foundations</td>
<td>171.7</td>
<td>6.3</td>
</tr>
<tr>
<td>Others</td>
<td>41.0</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,737.9</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Esterle et al. (2008)

Almost two-thirds of public biomedical R&D in France is performed in non-mission-oriented research institutions, namely universities (excluding CHU-CHR and CLCC) and CNRS. In 2003, 40.2 per cent of public biomedical R&D was carried out in universities and 18.9 per cent at CNRS.

Mission-oriented institutions include:
- public research institutes such as Inserm, INRA, CEA and IRD;
- higher education institutions such as CHU-CHR and CLCC; and
- foundations.

Inserm performs the largest share of public biomedical R&D among all mission-orientated institutions. Nevertheless, its share in total public biomedical R&D was only 15.5 per cent in 2003. Despite their key clinical and translational research mission, university hospitals execute a small share of public biomedical R&D, totalling 3.3 per cent of performance in 2003. Foundations, principally the Pasteur Institute, performed 6.3 per cent in the same year.
In 2005, 10,677 researchers (full-time equivalents) were involved in public biomedical research, representing 22 per cent of the stock of researchers in the public research sector.

More than two-thirds of researchers work in universities (including university hospitals) and at the National Centre for Scientific Research.

<table>
<thead>
<tr>
<th>Institutional bodies</th>
<th>Researchers (FTE) in biomedical research (2005)</th>
<th>Researchers (FTE) in the institution (2006)</th>
<th>% Total biomedical research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universities</td>
<td>4,170</td>
<td>25,060</td>
<td>39.1</td>
</tr>
<tr>
<td>CNRS</td>
<td>3,238</td>
<td>11,606</td>
<td>30.3</td>
</tr>
<tr>
<td>Inserm</td>
<td>2,181</td>
<td>2,181</td>
<td>20.2</td>
</tr>
<tr>
<td>INRA</td>
<td>357</td>
<td>1,925</td>
<td>3.3</td>
</tr>
<tr>
<td>IRD</td>
<td>88</td>
<td>752</td>
<td>0.8</td>
</tr>
<tr>
<td>Pasteur Institute</td>
<td>317</td>
<td>317</td>
<td>3.0</td>
</tr>
<tr>
<td>CEA</td>
<td>346</td>
<td>5,843</td>
<td>3.2</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>863</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,677</strong></td>
<td><strong>48,427</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Esterle et al. [2008]

In 2005, 10,667 researchers (full-time equivalents) participated in public biomedical R&D in France. This represented 22 per cent of the stock of researchers in the public research sector.

Almost 40 per cent of the researchers worked in universities (including CHU-CHR and CLCC) in 2005. CNRS and Inserm’s researchers respectively accounted for 30.2 per cent and 20.2 per cent of the stock of researchers in public biomedical research. The other researchers are mainly associated with INRA, CEA and the Pasteur Institute.
Scientific output: overall trends

- The French scientific contribution in fundamental biology and medical research is declining at the global level due to the emergence of new scientific and technological powers such as China, India and Brazil.
- Despite improvements, French research in medical research and to a lesser extent in fundamental biology lacks visibility at the global level.

<table>
<thead>
<tr>
<th>Scientific output</th>
<th>World share (%)</th>
<th>Change 06/01 (%)</th>
<th>Relative citation index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental biology</td>
<td>4.5</td>
<td>-15</td>
<td>0.97</td>
</tr>
<tr>
<td>Medical research</td>
<td>4.2</td>
<td>-17</td>
<td>0.87</td>
</tr>
<tr>
<td>All disciplines</td>
<td>4.4</td>
<td>-15</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Source: Esterle et al. (2008) based on Thomson Scientific and Observatoire des Sciences et des Techniques

To examine France’s output in medical research and related research fields, namely fundamental biology, and to compare it with other large EU countries, this briefing presents the results of bibliometric indicators based on the scientific publications indexed in the Web of Science.

The scientific contribution of France in medical research and fundamental biology, as measured by the world shares of scientific publications, amounted to 4.5 per cent and 4.2 per cent in 2006. France’s world shares in these fields declined significantly between 2001 and 2006, partly due to the emergence of new scientific powers at the global level, such as China, India and Brazil.

France’s scientific contribution in medical research and fundamental biology should be seen in relation to its scientific impact, which can be measured by the relative impact index. Despite an increase since 2001, the relative citation index of the French publications in medical research and fundamental biology was slightly lower than 1 (0.87 and 0.97, respectively) in 2006. This means that the French publications in these research fields enjoyed less visibility than the average of all articles published in the journals in which their articles appear.
fields had lower visibility than the average of all contributions published in the journals in which they appeared.
Scientific Output: European comparisons

- In terms of scientific contribution, France is increasingly lagging behind Germany and the United Kingdom, especially in medical research.
- France is less specialised in fundamental biology and medical research compared to Germany and the United Kingdom.
- Research in fundamental biology and medical research originating from Germany and the United Kingdom has higher impact at the global level.

<table>
<thead>
<tr>
<th>Disciplines</th>
<th>World share (%)</th>
<th>Specialisation index</th>
<th>Relative citation index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006 06/01</td>
<td>2006 06-Jan</td>
<td></td>
</tr>
<tr>
<td>Fundamental biology</td>
<td>4.5  -15</td>
<td>6.4 -6</td>
<td></td>
</tr>
<tr>
<td>Medical research</td>
<td>4.2 -17</td>
<td>6.7 -11</td>
<td>8.6 -14</td>
</tr>
<tr>
<td></td>
<td>1.02 -2</td>
<td>1.05 8</td>
<td>1.09 6</td>
</tr>
<tr>
<td>Medical research</td>
<td>0.97 -2</td>
<td>1.09 3</td>
<td>1.34 4</td>
</tr>
<tr>
<td></td>
<td>0.97 -5</td>
<td>1.07 0</td>
<td>1.21 8</td>
</tr>
<tr>
<td>Medical research</td>
<td>0.87 -6</td>
<td>0.97 12</td>
<td>1.02 7</td>
</tr>
</tbody>
</table>

In terms of scientific contribution, France is lagging behind Germany and the United Kingdom in medical research and fundamental biology. These two countries show higher world shares of scientific publications in 2006; moreover, their world shares in these two fields declined less rapidly between 2001 and 2006, despite increasing competition from new scientific powers.

Furthermore, medical research and research in fundamental biology originating from Germany and the United Kingdom is more visible at the global level, as shown by the relative citation index scores in both fields.

Finally, Germany and the United Kingdom are becoming increasingly specialised in medical research and fundamental biology, as measured by the ratio of their world share of publications in these fields to their world share of publications in all fields. In 2006, for example, the specialisation index of Germany and the United Kingdom in medical research amounted to 1.09 and 1.34, respectively. It only reached 0.97 in France the same year. However, France’s specialisation index in these fields declined between 2001 and 2006. In 2006, it amounted to 0.97 and 1.02 respectively in medical research and fundamental biology.

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It should be noted that this bibliometric indicators presented in this document are based on journal articles published in peer-reviewed international scientific and technical journals covered by the Web of Science, most of which are English-language publication outlets. This may bias the results in favour of English-speaking countries, such as the United Kingdom.
Examining the scientific output of the main research institutions in France reveals interesting facts. France’s lack of visibility in medical research and fundamental biology at global level is due mainly to universities’ low relative citation index. While universities amount to more than two-thirds of national publications in these fields, their relative citation index in medical research and fundamental biology remains lower than 1.7

In contrast, publications from other research bodies such as public research institutes and foundations are highly visible at global level. In 2006, the relative citation index of publications from CNRS, Inserm, CEA and the Pasteur Institute in these fields was higher than 1. The Pasteur Institute in particular shows remarkable scores in medical research and fundamental biology.

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7 The total of each line does not add up to 100% due to co-authorships among institutions. Each institution that publishes an article is credited with unitary participation.
Several recent evaluation reports have highlighted important weaknesses of the French health and medical research system. Governance of the French health and medical research system is too complex: too many different decision-making bodies have responsibility for the definition of the system’s main strategies; implementing the main strategies in scientific priorities and R&D programmes is dispersed among many executive bodies, resulting in dispersion of funding across research institutions and duplication of research efforts; research is often performed in institutions under the guardianship of several entities with different governance structures. French scientific output in medical research and fundamental biology shows vulnerabilities: France’s scientific contribution is declining rapidly; French research lacks visibility at the global level; other European countries are increasingly specialised in medical research and fundamental biology, contrary to France.

Several recent reports (Cour des Comptes, 2007; ARES, 2008; Esterle et al., 2008; Comité Ministériel d’Orientation de la Recherche, 2009; Marescaux, 2009) have stressed the important weaknesses of the French health and medical research system, particularly in its governance and scientific performance, and have called for its reform. These reports also emphasise the extreme complexity of governance of the system.

Strategic planning is the responsibility of too many decision-making bodies, including different ministries, making the system’s main strategies unclear. Moreover, several large public institutions such as CNRS and Inserm play a de facto role in definition of these strategies.

Implementing the main strategies in scientific priorities and R&D programmes is dispersed among too many executive bodies, such as funding and public health agencies, foundations and public research institutes. This results in a fragmented funding system and often in duplication of research effort. For example, CNRS and Inserm programmes overlap in research areas such as molecular biology, neurobiology, cellular biology and genetics.

It is interesting to note that similar that the Cooksey Review of UK health research funding raised concerns about the lack of any overarching UK health research strategy to ensure that priorities are considered through all types of research. The review also called for greater coordination between key funders in terms of setting future research priorities (Cooksey, 2006).
missions of several agencies also overlap. Moreover, certain institutions participating in strategic planning such as the Ministry of Health, Youth and Sport contribute to the programmatic decision process, which tends to make division of responsibilities within the system unclear.

Biomedical R&D is performed by many institutions from different institutional sectors, resulting in fragmentation of research effort. For example, mission-orientated institutions perform only approximately 40 per cent of public biomedical R&D. Despite their key roles in French health and medical research, Inserm and university hospitals only execute a limited share of public biomedical R&D. Besides, biomedical R&D is performed often in institutions under the joint authority of several entities with different management structures – this means that many research units have to deal with different financial, personnel and acquisitions mechanisms. Moreover, these research units often lack accountability because responsibilities are divided among different entities.

These reports highlight the vulnerabilities of the health and medical research system in terms of scientific performance. France’s scientific contribution in medical research and other related research fields has declined rapidly over the years. In addition, France is less specialised than other large European countries, such as Germany and the United Kingdom, in these research fields. Furthermore, its research often lacks visibility at the global level. Despite these signs of weakness and complex governance of the system, some institutions such as Inserm, CEA, CNRS and the Pasteur Institute show remarkable scientific performance.

To improve governance, recent reports (e.g. Comité Ministériel d’Orientation de la Recherche, 2009) recommend in particular a clearer division of responsibilities among the institutions involved in strategic planning, the programmatic decision-making process, research and evaluation, as follows:

- ministries should be responsible for defining the main system strategies (Comité Ministériel d’Orientation de la Recherche, 2009);
- the main funding agencies should implement these strategies in scientific priorities and R&D programmes – in this regard, the role of the main public research institutions in implementing these strategies should be clarified. For example, AERES (2008) suggests that the French institutions responsible for performing research should be separate from the institutions responsible for funding research;
- public medical research (mainly basic research) should be undertaken mainly by universities, while CHU should focus primarily on clinical research (e.g. Marescaux, 2009). Moreover, joint research units should be integrated into the institutions where they are physically, such as universities and CHUs (AERES, 2008); and
- AERES should play a critical role in the evaluation of the French health and medical research system.

To increase the system’s scientific performance, these reports recommend better allocation of research efforts among scientific fields (Esterle et al., 2008; Comité Ministériel d’Orientation de la Recherche, 2009). In particular, more effort should be devoted to
clinical research, public health, bioengineering, neurosciences, genetics and developmental biology, pharmacology and toxicology.

Finally, financial flows within French health and medical research should be made clearer in order to avoid funding fragmentation. Indeed, it is not possible to draw a cartography of these financial flows (Comité Ministériel d’Orientation de la Recherche, 2009). In this regard, AERES (2008) recommends that the funding streams for health research should be unified by creating a single National Institute for Life and Health Sciences Research.


