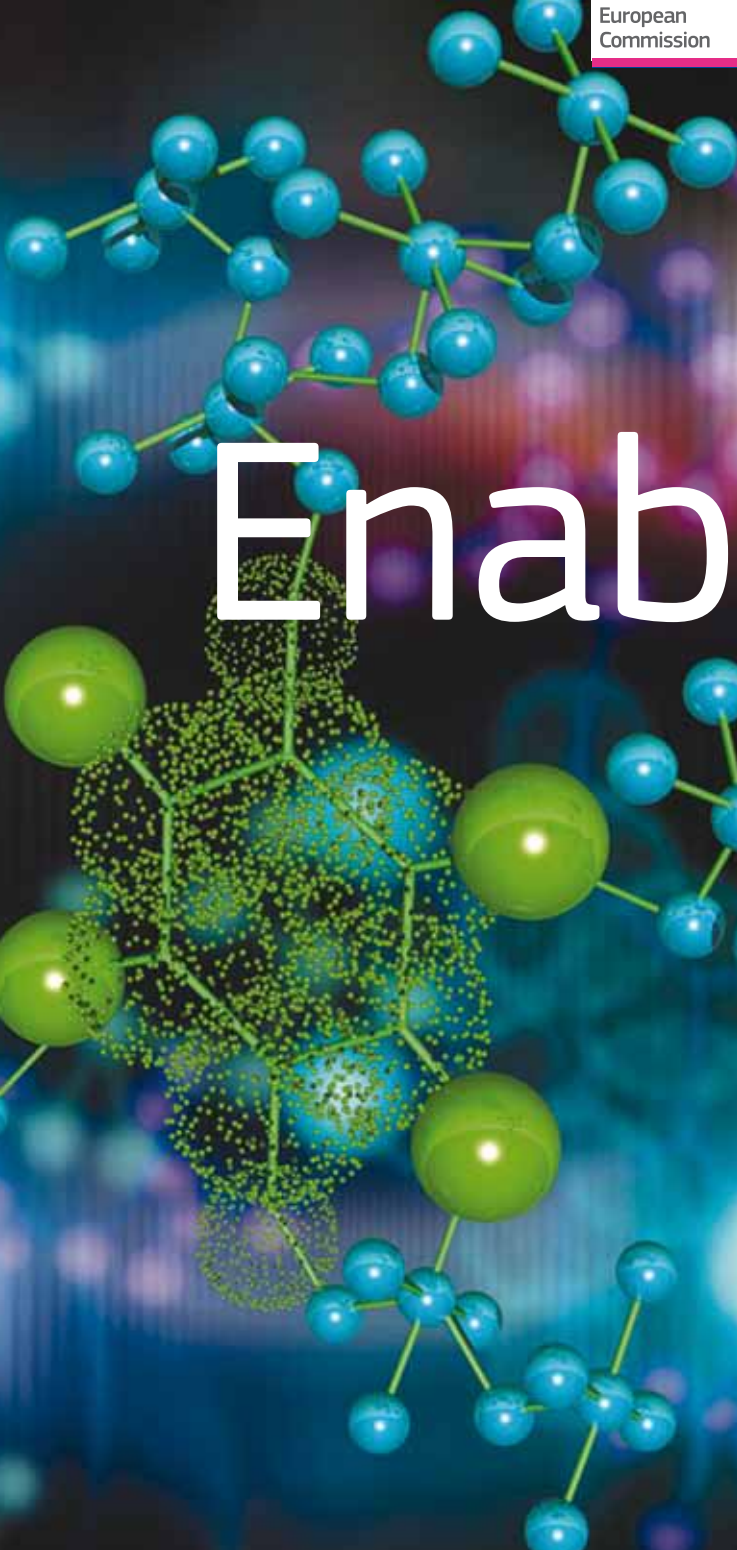




European  
Commission



# Enabling science

*EU support  
to research  
infrastructures in  
the life sciences*

Research and  
Innovation

**EUROPEAN COMMISSION**

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European Commission

# Enabling science

EU support to research infrastructures  
in the life sciences

2013

Directorate-General for Research and Innovation  
Research Infrastructures

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# *EU support to the life sciences ecosystem of facilities and resources*

The term **research infrastructures** refers to facilities, resources or services which are needed by the research community to conduct research in all scientific and technological domains. In the field of life sciences they include, for example, facilities such as imaging facilities, medical research facilities, genomics and proteomics facilities, biological resources centres, but also facilities for food and agriculture research as well as bioinformatics resources. This is a field that has undergone a tremendous scientific revolution. Let's take a look at the rise of molecular biology following the DNA structure discovery in the 1950s. The successes of molecular biology derived from the exploration of that unknown world by means of the new technologies developed by chemists and physicists. Since the 1990s these technologies can be found in every life science laboratory. Also, since the first genome sequencing that happened thanks to an international effort and cost more than EUR 2 billion, time and cost have been considerably reduced and there are now claims that an individual genome sequencing could be provided in a few hours for only around EUR 1 000.

Linked to these discoveries and developments other methodologies/technologies have rapidly evolved such as proteomics which is now high throughput, or structural biology. The integration of these technologies has allowed the opening of new doors in biology, and also the understanding of interactions through computing and simulation. The challenge is now to be able to deal with the amount and new type of data that is generated (including images and 4D, e.g. for folding of proteins). It is estimated, for example, that the level of data at the European Molecular Biology Laboratory/European Bioinformatics Institute (EMBL/EBI) is doubling every 5 months.

The European research landscape in this field is illustrated by the number of researchers involved as well as by the nature and number of research infrastructures. If we base ourselves on the total number of researchers (head count) in the European Union in 2009 <sup>(1)</sup> and the fact that 22.5 % of doctoral candidates are in health, welfare, agriculture and veterinary domains <sup>(2)</sup>, we can fairly estimate that we have in the EU around 500 000 life scientists.

## **An ecosystem of facilities and resources**

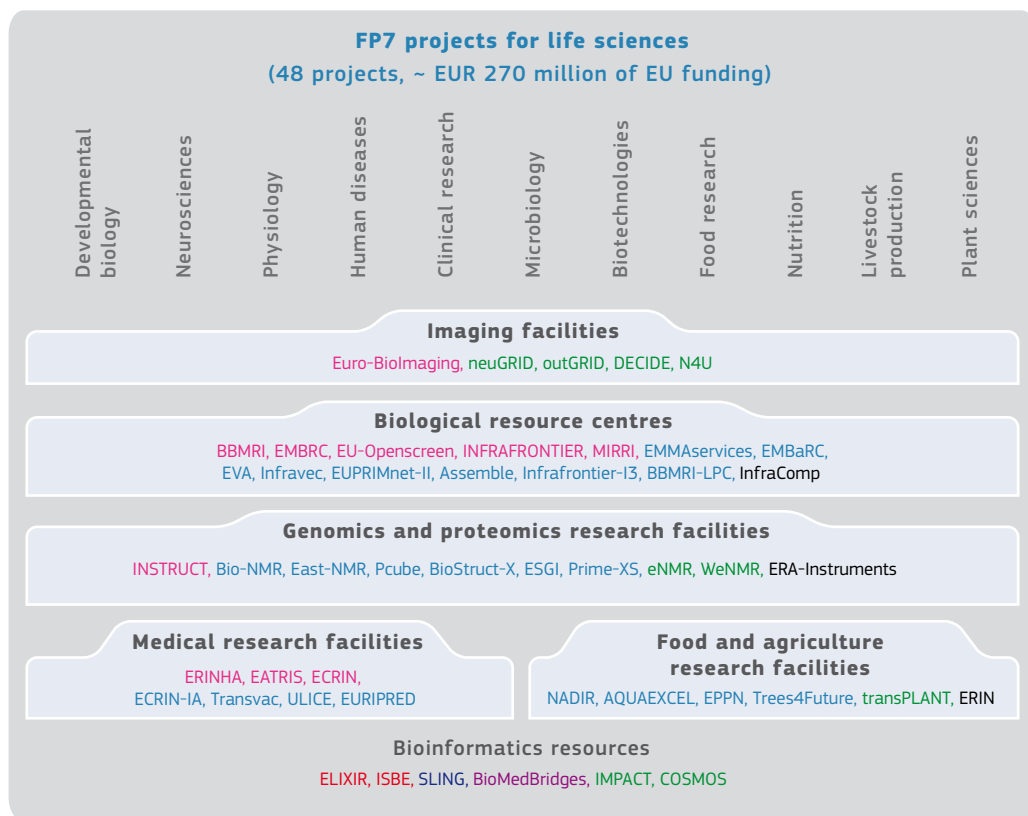
Research infrastructures (RIs) in the domain of life sciences are composed of an ecosystem of facilities and resources from local, regional to European, even worldwide dimension. The European Molecular Biology Laboratory (EMBL) which was created following the important development of molecular biology, is playing an important role. In addition, 12 infrastructures in the field of health and food have been identified in the Roadmap of the European

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(1) Innovation Union Competitiveness report — 2011 edition (EUR 24211).

(2) International Standard Classification of Education (ISCED) — ISCED 1997 level 6.

Strategy Forum on Research Infrastructures (ESFRI) <sup>(3)</sup>. All these projects have been or are supported in their preparatory phase under the seventh framework programme (FP7) representing EUR 160 million of funding. Overall, the current coverage and funding from FP7 has allowed 48 research infrastructure projects in life sciences to be supported for a total amount of around EUR 270 million. This support covers infrastructures of a horizontal nature that have application in all domains such as imaging facilities, biological resources centres, and technological resources such as genomics and proteomics. It also covers more thematic RIs like those around medical applications and those around agri-food research. The last domain of RIs covered by FP7 is the bioinformatics resources in support of all other domains.



**Figure 1:** Projects supported under FP7 in the field of life sciences.

Legend:

In red: ESFRI projects; in blue: integrating activity projects; in green: e\_infrastructures projects; in purple: implementation phase project

(3) The ESFRI AnaEE project (Analysis and Experimentation on Ecosystems) is not covered by this report.



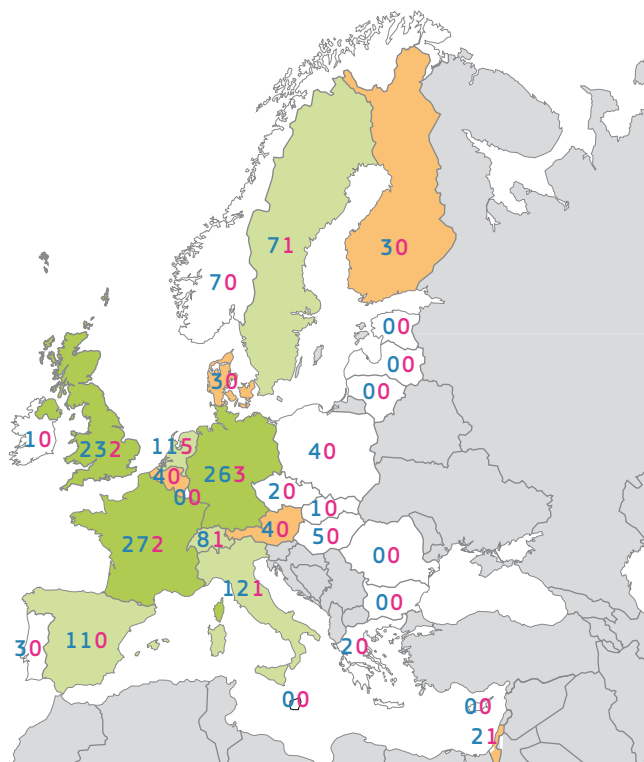
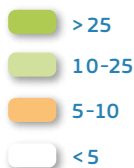
FP7 offered an opportunity to very significantly broaden the thematic coverage of infrastructures for the life sciences, including agriculture when compared to FP6 (Figure 1). Nevertheless, there still exist several categories of infrastructures not yet covered by FP7 and which may benefit from integrating efforts (e.g. plant genetic resources, experimental farms, food analysis facilities, etc.).

A vast majority of infrastructures funded under FP7 offer services to multiple life sciences disciplines and all of them, including e-infrastructures, do contribute to addressing major societal challenges such as health and food security. It is worth mentioning that a majority of infrastructures identified by ESFRI have been previously funded under the framework programme, thus demonstrating the structuring impact of the action in the domain of life sciences, and its contribution to building the European Research Area (ERA). In addition, looking at preliminary data on users who benefited from access to FP7 funded infrastructures, FP7 clearly allowed for an increased and facilitated access, thus again contributing to building the ERA. Research infrastructures are located in ‘big’ countries, and in peripheral countries such as Sweden, Norway, Switzerland, Hungary (Figure 2). This is in coherence with the percentage of GDP invested in research. By the end of FP7, around 3 % of life scientists would have benefited from transnational access offered by the programme. Looking at the data from the first 1 000 users in life sciences, we can say that they come from smaller countries and countries where such research infrastructures are not present, thereby illustrating the usefulness of the programme.

### Access to Life Sciences RIs

FP7: 169 RIs  
 FP6: 16 RIs

GERD (billion EUR, 2009)



The impact of the programme in this domain can be illustrated through examples from projects:

- The possibility to carry out excellent and innovative research based on access funding in the context of P-CUBE allowed the determination of the structure of the plant receptor for abscisic acid (drought resistance). This work using facilities offered in P-CUBE led to a publication (\*) in *Nature* in 2009.
- SLING allowed the training of more than 500 users of bioinformatics services through roadshows.
- Emmaservice has developed unified services to a distributed repository of more than 2 200 mouse strains through a single entry point.
- N4U has developed virtual services through a virtual laboratory to analyse images on patients with neurodegenerative diseases.
- EUPRIM-Net has been very successful in advancing best practices and highest standards in animal welfare. A handbook and a DVD on Positive Reinforcement Training were produced as well as more than 30 courses offered for personnel working with non-human primates.
- outGRID allowed the development of common standards and interoperability towards a unique global infrastructure for neuro-images.
- ULICE works on the development of innovative lightweight rotating delivery systems, for 4D ion radiotherapy specifically optimised to the clinical environment.

The next challenges in the field of life sciences include in particular addressing properly the thematic gaps, the data challenge and reinforcing cooperation with other actions such as joint programming initiatives and future emerging technologies flagship initiatives to better respond to the grand societal challenges.

## Support provided to research infrastructures under FP7

Research infrastructures play an increasing role in the advancement of knowledge and technology and their exploitation. For example, radiation sources, data banks in genomics and data banks in social sciences, observatories for environmental sciences, systems of imaging or clean rooms for the study and development of new materials or nano-electronics, are at the core of research and innovation processes. By offering high quality research services to users from different countries, including from the peripheral and outermost regions, by attracting young people to science and by networking facilities, research infrastructures help in structuring the scientific community and play a key role in the construction of an efficient research and innovation environment. Because of their ability to assemble a 'critical mass' of people, knowledge and investment, they contribute to national, regional and European economic development. They are therefore at the core of the knowledge triangle of research, education and innovation.

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(\*) 'The abscisic acid receptor PYR1 in complex with abscisic acid', 2009, Santiago et al., *Nature* 462, pp. 665–668.

The overall objective of the research infrastructures part of FP7 (under the 'Capacities' specific programme) is to optimise the use and development of the best research infrastructures existing in Europe, and to help to create in all fields of science and technology new research infrastructures of pan-European interest needed by the European scientific community to remain at the forefront of the advancement of research, and to be able to help industry to strengthen its base of knowledge and its technological know-how. While Member States remain central in the development and financing of most infrastructures, the EU, via the research programme FP7, plays a catalysing and leveraging role by helping to ensure wider and more efficient access to and use of the infrastructures existing in the different Member States. The EU actions also stimulate the coordinated development, deployment and networking of these infrastructures, and foster the emergence of new research infrastructures of pan-European interest within a medium- to long-term vision.

Within the scope of this EU action, research infrastructures are defined as facilities, resources, systems and related services that are used by research communities to conduct top-level research in their respective fields. This definition covers: major scientific equipment or set of instruments; knowledge-based resources such as collections, archives or structured scientific information; ICT-based e-infrastructures (networks, computing resources, software and data repositories) for research and education; any other entity of a unique nature essential to achieving or enabling excellence in research. Research infrastructures may be single-sited or distributed (a network of resources).

In the domain of life sciences, 48 research infrastructure projects are being or have been funded under FP7 so far. This document presents an overview of these projects and their objectives <sup>(5)</sup>.

The EU will continue to support research infrastructures under Horizon 2020 ensuring Europe has world-class research infrastructures (including e-infrastructures) accessible to all researchers in Europe and beyond. The activities will also contribute to fostering the innovation potential of RIs with a focus on instrumentation and the participation of industry, and on reinforcing international cooperation with strategic third country partners.

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<sup>(5)</sup> For further information on the EU action for research infrastructures browse the Europa and Cordis websites: <http://www.europa.eu/research/infrastructures>; and [http://cordis.europa.eu/fp7/ict/e-infrastructure/home\\_en.html](http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html)  
We would like to thank Jean-Emmanuel Faure and Brigitte Sambain for their valuable contribution to this publication.

## Cell and medical imaging facilities and resources

Imaging is a multidisciplinary field involving the generation, collection, duplication, analysis, modification, and visualisation of images. Imaging is a central technology of life sciences, including biomedical research and healthcare practice. The field is currently booming with innovation and Europe has a leadership position. Further improvement in the accuracy and resolution of imaging techniques is required and will have a major impact in the healthcare sector as well as for the European economy.



ESFRI identified one priority project (in its 2008 Roadmap), **Euro-BioImaging**, the European biomedical imaging infrastructure — from Molecule to Patient. The Euro-BioImaging infrastructure is planned to provide access and training to state-of-the-art imaging technologies across the full range of biological and medical applications, from molecule to patient. It will be organised as a pan-European distributed infrastructure. It will be focused on complementary imaging technologies

from basic biological imaging with advanced light microscopy, *in vivo* molecular imaging of single cells to animal models, up to the clinical and epidemiological level of medical imaging of humans and populations.

FP7 provides support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

- ▶ Preparatory phase project
- ▶ EUR 5 200 000 (2010–13)
- ▶ <http://www.eurobioimaging.eu>
- ▶ 39 partners, coordinated by the European Molecular Biology Laboratory, Germany

Complementary to Euro-BioImaging, FP7 supports a coherent group of four e-infrastructure projects all dedicated to developing a global imaging laboratory based on grid and cloud computing, offering services to the research community on Alzheimer's disease and other neurodegenerative diseases. Services offered range from simple access to distributed images and clinical data, to advanced imaging pipelines execution and monitoring, quality control interfaces for experiment outputs and data clean-up, as well as interfaces for collaboration. Such services will help in identifying markers of the diseases or biological parameters that allow accurate and early diagnosis of the diseases and their progression. The four projects are:

**neuGRID**, grid-based e-infrastructure for data archiving/communication and computationally intensive applications in the medical sciences.

- ▶ e-infrastructure project
- ▶ EUR 2 800 000 (2008-2011)
- ▶ [www.neuGRID.eu](http://www.neuGRID.eu)
- ▶ 8 partners, coordinated by the Provincia Lombardo-Veneta — Ordine Ospedaliero di San Giovanni di Dio Fatebenefratelli (FBF), Italy

**outGRID**, worldwide e-infrastructure for computational neuroscientists

- ▶ e-infrastructure project
- ▶ EUR 439 982 (2009-2012)
- ▶ [www.outgrid.eu](http://www.outgrid.eu)
- ▶ 6 partners, coordinated by FBF, Italy

**N4U**, NeuGRID for you: expansion of NeuGRID services and outreach to new user communities

- ▶ e-infrastructure project
- ▶ EUR 3 600 000 (2011-2014)
- ▶ [www.neugrid4you.eu](http://www.neugrid4you.eu)
- ▶ 11 partners, coordinated by FBF, Italy

**DECIDE**, Diagnostic Enhancement of Confidence by an International Distributed Environment

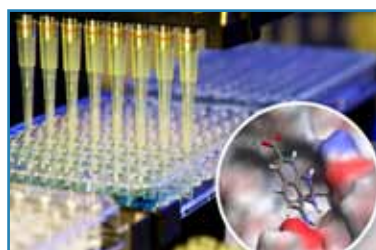
- ▶ e-infrastructure project
- ▶ EUR 2 400 000 (2010-2013)
- ▶ [www.eu-decide.eu](http://www.eu-decide.eu)
- ▶ 13 partners, coordinated by Consortium GARR, Italy

The neuGRID consortium has built the core of the infrastructure (computational nodes, connectivity, middleware, and a set of core applications for image processing). The DECIDE consortium has already introduced onto neuGRID tools for the automated assessment of diagnostic markers from functional PET, computation of brain atrophy from volumetric structural MRI and spectral-based analysis of EEG studies. The outGRID consortium has promoted the interchange of technical information of neuGRID with two similar e-infrastructures in North America (LONI at UCLA in Los Angeles, and CBRAIN in Canada). OutGRID also developed a common strategic agenda, and carried out concertation activities (personal meetings, workshops, public events, media broadcasts) at the global level. N4U is expanding the services of neuGRID with a user-oriented architecture in order to help neuroscientists accelerate the development, testing and validation of innovative and computationally demanding image analysis pipelines.

# Chemical libraries and screening platforms

A chemical library is a collection of chemicals usually used in high-throughput screening or industrial manufacture. Each chemical has associated information such as the chemical structure, purity, quantity, and physiochemical characteristics of the compound, stored in a database.

There is a class of organic chemicals, named 'small molecules', that is used to study the functions of the cell at the genome level. Such molecules are also valuable for treating everything from headaches to cancer. In fact, most medicines, from aspirin to antihistamines, are small molecule compounds. Researchers need libraries of these chemicals to maximise the likelihood of a successful match between a chemical compound, its usefulness as a research tool or its desired therapeutic effect by systematically screening libraries containing thousands of small molecules.



**EU-OPENSREEN**, the European infrastructure of open screening platforms for chemical biology was identified by ESFRI as a priority project (in its 2008 Roadmap). EU-OPENSREEN will provide access to bioactive small molecules. A large collection of diverse compounds, representing the chemical knowledge in Europe, will be available for many fields of the life sciences, e.g. human and veterinary medicine, systems biology, biotechnology, agriculture, nutrition. It will also offer access to services

in all of chemical biology: high-throughput screening, chemical synthesis for hit-optimisation, bio-profiling and *in vivo* studies, a central database, and training.

FP7 provides support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

- ▶ Preparatory phase project
- ▶ EUR 3 700 000 (2010-2013)
- ▶ <http://www.eu-openscreen.de>
- ▶ 16 partners, coordinated by the Forschungsverbund Berlin E.V., Germany

## Biological resource centres

According to the Organisation for Economic Cooperation and Development (OECD), biological resource centres (BRCs) 'consist of service providers and repositories of the living cells, genomes of organisms, and information relating to heredity and the functions of biological systems. BRCs contain collections of culturable organisms (e.g. micro-organisms, plant, animal and human cells), replicable parts of these (e.g. genomes, plasmids, viruses, cDNAs), viable but not yet culturable organisms cells and tissues, as well as databases containing molecular, physiological and structural information relevant to these collections and related bioinformatics' <sup>(6)</sup>.

Organisms, cells, genes and the related data constitute basic material for research and innovation in all fields of life sciences, from health to biotechnology and agriculture. Access to efficient infrastructures collecting, preserving, reproducing and distributing such biological resources is therefore vital in Europe and worldwide. Over the last decades, both governments and industry have significantly invested in collecting and generating biological resources. It is now important to capitalise on such investments, to avoid duplication of effort, and to create synergies between existing initiatives. It is essential to develop and implement quality standards, as the value of biological resource centres lies very much in the quality of the material they provide. It is also essential to advance the 3Rs: Replacement (methods which avoid or replace the use of animals), reduction (minimising the numbers of animals used), and refinement (improving experimental procedures, and other factors affecting animals). Such objectives require working at a multinational level and numerous activities have been initiated in Europe, with support from FP7.

### Microbial resources

In this field of biological resources, ESFRI identified one priority project (in its 2010 Roadmap), **MIRRI**, the Microbial Resource Research Infrastructure. MIRRI will bring together European microbial resource collections (including bacteria, fungi, virus), aiming at improving access to enhanced quality microbial resources in an appropriate legal framework. It will build the European platform within the future Global Biological Resource Centre Network (GBRCN) for microorganisms.

FP7 provides support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

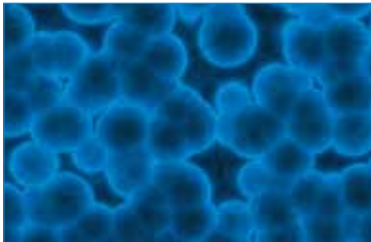
- ▶ Preparatory phase project
- ▶ EUR 3 137 774 (2012-2015)
- ▶ [www.mirri.org](http://www.mirri.org)
- ▶ 16 partners, coordinated by the Leibniz-Institut DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Germany

<sup>(6)</sup> 'Best Practice Guidelines for BRCs', OECD, 2007, <http://www.oecd.org>



MIRRI originates from an earlier FP7 funded integrating activity, **EMbaRC**, the European Consortium for Microbial Resource Centres. The objective of the EMbaRC project is to integrate European microbial resource centres, representing a large biodiversity and offering a wide range of not only bio-resources but also expert services. Collections of fungi and bacteria are indeed important tools for food and agricultural research. The project should also enable other European resource centres, especially those which are endangered or isolated, to be integrated and to ensure their future existence. EMbaRC proposes an extensive training of users and outreach programme, provides access to key European collections, and will collaboratively improve strain and DNA storage as well as identification methods for microorganisms.

- ▶ Integrating activity project
- ▶ EUR 4 191 844 (2009-2012)
- ▶ [www.embarc.eu](http://www.embarc.eu)
- ▶ 10 partners, coordinated by the Institut National de la Recherche Agronomique, France



Microbial resources are also covered by another FP7-funded integrating activity, **EVA**, the European Virus Archive. During the past 70 years or more, thousands of viruses have been isolated and partly characterised by experts working in different countries worldwide. These viruses potentially provide a unique and extremely valuable medical and educational resource for research and development to understand the basis of virus diseases, and to develop modern state of the art strategies for

disease control. The objective of the EVA project is to develop a readily accessible virus reference library at the European level, based on the expertise and facilities of recognised centres of excellence in virology distributed in Europe. EVA develops appropriate protocols for virus amplification, supported by sustainable long-term storage facilities. It also exploits the high international reputations of its centres to obtain viruses currently held outside Europe. The project offers access to all users who can demonstrate the appropriate bio-security credentials. An associated technology transfer centre develops products for diagnosis, research, therapeutic application, education, and training.

- ▶ Integrating activity project
- ▶ EUR 6 300 000 (2009-2013)
- ▶ [www.european-virus-archive.com](http://www.european-virus-archive.com)
- ▶ 9 partners, coordinated by the Institut de Recherche pour le Développement, France



## Mosquito repositories



FP7 provides support to **INFRAVEC**, the research capacity for the implementation of genetic control of mosquitoes. Mosquitoes transmit a variety of infectious diseases that cause a tremendous burden to public health. INFRAVEC aims at bridging the gap between the recent advances in transgenic technology and its implementation as a novel approach for mosquito vector control. The project brings together and offers access for external users to mosquito mass-rearing facilities, mosquito

confined release facilities, genetically modified mosquito laboratories, and bioinformatics resources. INFRAVEC mainly focuses on *Anopheles gambiae*, the major vector of malaria, and *Aedes albopictus*, a viral disease vector that is rapidly spreading through Europe.

- ▶ Integrating activity project
- ▶ EUR 8 499 618 (2009-2013)
- ▶ [www.infravec.eu](http://www.infravec.eu)
- ▶ 31 partners, coordinated by the Imperial College of Science, Technology and Medicine, United Kingdom

## Mouse repositories and phenotyping centres



In this field of biological resources, ESFRI identified one priority project (in its 2006 Roadmap), **Infrafrontier**, the European infrastructure for phenotyping and archiving of model mammalian genomes. The infrastructure will provide the facilities and resources for the phenotyping of medically relevant mouse models, and for the archiving and dissemination of those models. Mice indeed constitute a model system to understand the molecular basis of health and disease in humans, due in particular to the high (> 95 %) similarity of genes with humans.

FP7 provided support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

Infrafrontier is currently preparing statutes to be established as a European Research Infrastructure Consortium (ERIC) or a German company with limited liability (GmbH).

- ▶ Preparatory phase project
- ▶ EUR 4 500 000 (2008-2012)
- ▶ [www.infrafrontier.eu](http://www.infrafrontier.eu)
- ▶ 28 partners, coordinated by the Helmholtz Zentrum München Deutsches Forschungszentrum für Gesundheit und Umwelt GmbH, Germany

Infrafrontier was supported through earlier projects. First, FP7 supported the **EMMAservice**, for servicing the European biomedical research community: archiving and dissemination of mouse models of human diseases. The mouse shows great similarities in development, physiology and biochemistry to humans, which makes it a key model for research into human disease. Building on previous achievements by the European Mouse Mutant Archive (EMMA) as the primary mouse repository in Europe, EMMAservice aims to meet the future challenges presented by archiving and disseminating mouse models. The project aimed at: (1) archiving and distributing up to 1 340 new mouse mutant lines in support of individual depositors and also European mouse genetics programmes, (2) advancing current sperm-freezing technology and simplifying the transportation of pre-implantation embryos, (3) implementing training courses to promote the shipment of frozen germplasm rather than live mice, (4) developing EMMA informatics for user-friendly services, data curation and cross referencing with other mouse database resources, (5) deploying efforts to attract new users.

- ▶ Integrating activity project
- ▶ EUR 8 000 000 (2009-2012)
- ▶ [www.emmanet.org](http://www.emmanet.org)
- ▶ 10 partners, coordinated by the Consiglio Nazionale Delle Ricerche, Italy

A continuation project, **Infrafrontier-I3**, Development of mouse mutant resources for functional analyses of human diseases — Enhancing the translation of research into innovation, is funded under FP7. The Infrafrontier-I3 project brings together the leading European centres for systemic phenotyping of mouse mutants and the repositories of the European Mouse Mutant Archive network. The focus of the Infrafrontier-I3 project is on the provision of state-of-the-art user services ranging from cryopreservation to mouse production, first line phenotyping and to the specialised axenic service. The comprehensive physical and data resources that will be generated by Infrafrontier-I3 will contribute to link basic biomedical research to human health and disease and to medical applications.

- ▶ Integrating activity project
- ▶ EUR 9 900 000 (2013-16)
- ▶ 23 partners, coordinated by Helmholtz Zentrum München Deutsches Forschungszentrum für Gesundheit und Umwelt GmbH, Germany

A complementary project, **InfraCoMP**, coordinating the cooperation of the ESFRI project Infrafrontier with the International Phenotyping Consortium — IMPC, aims at establishing efficient coordination mechanisms between Infrafrontier and the International Mouse Phenotyping Consortium (IMPC) via the organisation of a series of joint workshops. The IMPC, an ongoing global effort to carry out systemic phenotyping of mouse lines to create an encyclopaedia of the mammalian genome, will use, in particular, the infrastructure resources provided by Infrafrontier.

- ▶ Coordination action project
- ▶ EUR 779 997 (2011-2014)
- ▶ 9 partners, coordinated by the Helmholtz Zentrum München Deutsches Forschungszentrum für Gesundheit und Umwelt GmbH, Germany

## Non-human primate centres



*Lemur catta* © Margrit Hampe

In this field of biological resources, FP7 provides support to **EUPRIM-Net II**, the European Primate Network – Advancing 3Rs and International Standards in Biological and Biomedical Research. The project brings together the key European primate centres that combine keeping and breeding as well as experimental studies of primates in scientific research. The objective is to improve the services offered by the participants, support the best science that meets the highest ethical standards for primate-based animal research. It will advance the

3Rs: replacement (methods which avoid or replace the use of animals), reduction (minimising the numbers of animals used), and refinement (improving experimental procedures and other factors affecting animals). The project will reinforce the implementation of good practices in Europe and develop the necessary collaborations outside Europe for a global sharing of available resources. This integrating activity project started on 1 January 2011, continuing previous efforts under FP6.

- ▶ Integrating activity project
- ▶ EUR 7 000 000 (2011-2014)
- ▶ [www.euprim-net.eu](http://www.euprim-net.eu)
- ▶ 9 partners, coordinated by the Deutsches Primatenzentrum GmbH, Germany

## Biobanks and cohorts



*Hermetic semi-automated cryo-storage system*

**BBMRI**, the Biobanking and Biomolecular Resources Research Infrastructure was identified by ESFRI as a priority project (in its 2006 Roadmap). BBMRI will provide access to partner bio-banks (collections of blood, DNA, tissue, etc., together with medical, environmental, life-style data), as well as bio-molecular resources, throughout Europe. Such collections of samples and clinical data from patients and healthy persons, and associated tools, are essential for undertaking clinical research and for defining prevention strategies. The infrastructure will

offer common services for improving interoperability, for quality management, for information technology support, and for ethical, legal and societal issues support.

FP7 provided support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

- ▶ Preparatory phase project
- ▶ EUR 4 999 305 (2008-2011)
- ▶ [www.bbmri.eu](http://www.bbmri.eu)
- ▶ 53 partners, coordinated by the Medizinische Universität Graz, Austria

In August 2012, BBMRI submitted an application to the European Commission for the establishment of an ERIC <sup>(7)</sup> legal entity.

FP7 provides support to a project covering some of the BBMRI resources. The **BBMRI-LPC** project brings together the Large Prospective Cohorts of BBMRI and the International Agency for Research on Cancer (IARC). It will provide direct access to sample collections and associated health information as well as to data derived by analysis of these samples by omics technologies. It will build on the planning of BBMRI and develop further specific solutions improving access to large prospective cohorts.

- ▶ Integrating activity project
- ▶ EUR 8 000 000 (2013–17)
- ▶ 30 partners, coordinated by the University of Helsinki, Finland

## Marine biological stations

ESFRI identified one priority project (in its 2008 Roadmap), **EMBRC**, the European marine biological resource centre. The EMBRC infrastructure will be planned to provide access to model marine organisms and related genomic resources in Europe. The main coastal marine laboratories will be integrated to support high-level research in basic biology, marine biology and ecology with modern technology and ‘omics’ platforms. It will promote access for both research and training.

FP7 provides support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

- ▶ Preparatory phase project
- ▶ EUR 3 880 000 (2011-2014)
- ▶ [www.embrc.eu](http://www.embrc.eu)
- ▶ 12 partners, coordinated by the Stazione Zoologica Anton Dohrn, Italy

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(7) More information on ERIC, the European Research Infrastructure Consortium, and on progress of the applications at: [http://ec.europa.eu/research/infrastructures/index\\_en.cfm?pg=eric](http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=eric)



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EMBRC originates from an earlier FP7-funded integrating activity project, **ASSEMBLE**, the 'Association of European Marine Biological Laboratories'. The objective of the project is to develop an integrated infrastructure that will make it possible for biologists in Europe to access and study a range of unique coastal ecosystems and a wide variety of marine organisms using the most advanced approaches in modern biology. For this purpose, the project brings together key marine biological research stations around the European coastline including the sub-tropical station at Eilat, Israel. It also includes a Pacific site in Chile (PUC) that provides access to one of the most important upwelling sites in the world. It offers access to indoor and outdoor equipment for the cultivation, the raising and the study of a wide range of marine organisms, as well as to the related expertise.

- ▶ [Integrating activity project](#)
- ▶ [EUR 8 700 000 \(2009-2014\)](#)
- ▶ [www.assemblemarine.org](http://www.assemblemarine.org)
- ▶ [8 partners, coordinated by Göteborgs Universitet, Sweden](#)

## *Genomics and proteomics research facilities*

The ability to sequence DNA and to detect the expression of tens of thousands of genes in parallel has become a mainstay of 21st century biology. The development of DNA sequencing techniques has enabled the establishment of comprehensive genome sequencing projects. The advent of these technologies resulted in a rapid intensification in the scope and speed of completion of genome sequencing projects. A rough draft of the human genome was completed by the Human Genome Project in early 2001. This project, completed in 2003, sequenced the entire genome for one specific person, and by 2007 this sequence was declared 'finished' (less than one error in 20 000 bases and all chromosomes assembled). In the years since then, the genomes of many other individuals have been sequenced, partly under the auspices of the 1 000 Genomes Project, which announced the sequencing of 1 092 genomes in October 2012. Completion of this project was made possible by the development of dramatically more efficient sequencing technologies and required the commitment of significant bioinformatics resources from a large international collaboration. The high demand for low-cost sequencing has driven the development of high-throughput sequencing (or next-generation sequencing (NGS)) technologies that parallelise the sequencing process, producing thousands or millions of sequences at once. High-throughput sequencing technologies are intended to lower the cost of DNA sequencing beyond what is possible with standard dye-terminator methods. In ultra-high-throughput sequencing, as many as 500 000 sequencing-by-synthesis operations may be run in parallel.

After genomics, proteomics is the next step in the study of biological systems. Proteomics encompasses the analysis of proteins within any given biological sample on a global scale. It demands the application of evolving multidisciplinary technologies to enable the measurement and characterisation of protein expression profiles, protein localisation, modifications and networks related to development, health/disease and other biological processes. To understand how thousands of cellular proteins are affected during growth or as a result of drug treatment or environmental stresses, technically advanced approaches such as mass spectrometry (MS) have become essential research tools. Mass spectrometers permit identifying protein sequences and their abundance. These technologies help researchers in understanding molecular details such as protein modifications and components of protein complexes.

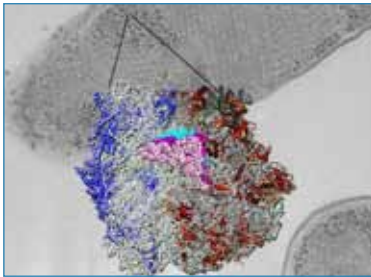


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- ▶ Integrating activity project
- ▶ EUR 9 500 000 (2011-2015)
- ▶ [www.esgi-infrastructure.eu](http://www.esgi-infrastructure.eu)

FP7 provides support to **ESGI**, the European Sequencing and Genotyping Infrastructure. The objective of this project is the integration of world class high-throughput sequencing and genotyping facilities. The project in particular provides access to sequencing and genotyping technologies as well as data analysis methodologies to the scientific community, for a broad range of genetic and systems biology studies using well-phenotyped samples, for example those derived from standardised European biobanks and animal facilities.

- ▶ 11 partners, coordinated by the Max Planck Gesellschaft zur Förderung der Wissenschaften E.V., Germany



*Virus particles along with ribosomes — an expanded structural representation*

For structural biology, ESFRI identified one priority project (in its 2006 Roadmap), **Instruct**, the Integrated Structural Biology Infrastructure. Instruct will consist of distributed centres for structural biology. All centres will maintain a set of core technologies (e.g. protein production, NMR, crystallography, microscopy) accessed by users to obtain multi-scale structural data.

FP7 provided support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

A company, 'Instruct Academic Services Limited', was created for the purpose of coordinating the activities of the institution's member of Instruct (representing 16 core centres of structural biology, in eight countries, i.e. the Czech Republic, France, Germany, Israel, Italy, Portugal, the Netherlands and the United Kingdom). In February 2012, Instruct formally began its operational phase on signing an accession agreement between the Instruct members and the company, and opening a single entry point for the users.

- ▶ Preparatory phase project
- ▶ EUR 4 499 988 (2008-2011)
- ▶ [www.structuralbiology.eu](http://www.structuralbiology.eu)

- ▶ 12 partners, coordinated by the Chancellor, masters and scholars of the University of Oxford, United Kingdom

Several key components of Instruct are being supported by additional FP7 projects. A first project is **P-CUBE**, the Infrastructure for Protein Production Platforms. The project combined existing infrastructures and know-how of leading European laboratories in bacterial and eukaryotic expression of proteins, in high-throughput crystallisation and in libraries designed for the effective production and crystallisation of macromolecules. Access was offered to these various platforms to ensure that research groups can produce the proteins required for their structural studies. Joint research activities aimed at improving the methods in the various areas of the project. These included the improvement of the automation for synthesising DNA constructs, for parallel expression, for improved libraries, for the efficient selection of affinity molecules from libraries to particular target proteins as well as developing new methods for crystallisation at the nanoliter scale.

- ▶ Integrating activity project
- ▶ EUR 6 599 997 (2009-2013)
- ▶ [www.p-cube.eu](http://www.p-cube.eu)
- ▶ 3 partners, coordinated by the Universität Zürich, Switzerland



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high throughput crystallisation, macromolecular X-ray crystallography, small angle X-ray scattering and X-ray imaging.

- ▶ Integrating activity project
- ▶ EUR 9 000 000 (2011-2015)
- ▶ [www.biostruct-x.eu](http://www.biostruct-x.eu)
- ▶ 19 partners, coordinated by the European Molecular Biology Laboratory



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A third project is **Bio-NMR**, NMR for structural biology. The objective of this project is to integrate and coordinate 11 transnational access-providing infrastructures, plus several top laboratories across Europe carrying out world-class research advancing NMR methodology. The project in particular provides access to a broad range of state-of-the-art, sophisticated NMR instrumentation to users primarily aiming at solving structures of biological macromolecules and their complexes including to pharmaceutical and biotech companies.

- ▶ Integrating activity project
- ▶ EUR 9 000 000 (2010-2014)
- ▶ [www.bio-nmr.net](http://www.bio-nmr.net)
- ▶ 19 partners, coordinated by the Consorzio Interuniversitario Risonanze Magnetiche di Metalloproteine Paramagnetiche, Italy



A fourth project is **East-NMR**, Enhancing access and services to east European users towards an efficient and coordinated pan-European pool of NMR facilities. The project aimed at providing transnational access to NMR instrumentation based in eastern Europe. It provided access to solid-state NMR facilities, an emerging technology at the international level. It also aimed to educate and train researchers in NMR's potential and use, with special care for eastern Europeans.

- ▶ Integrating activity project
- ▶ EUR 3 499 997 (2009-2013)
- ▶ [www.east-nmr.eu](http://www.east-nmr.eu)
- ▶ 21 partners, coordinated by the Johann Wolfgang Goethe Universität Frankfurt Am Main, Germany

A fifth project is **e-NMR**, for deploying and unifying the NMR e-infrastructure in system biology. The e-NMR project deployed and unified the NMR computational infrastructure. The main objective was indeed to optimise and extend the use of the NMR research infrastructures through the implementation of an e-infrastructure in order to provide the biomolecular NMR user community with a platform integrating and streamlining the computational approaches necessary for NMR data analysis and structural modelling. Access to the e-NMR infrastructure is now provided through a portal integrating commonly used NMR software and GRID technology.

- ▶ e-infrastructure project
- ▶ EUR 2 050 000 (2007-2010)
- ▶ [www.enmr.eu](http://www.enmr.eu)
- ▶ 8 partners, coordinated by the Johann Wolfgang Goethe Universität Frankfurt Am Main, Germany

The e-NMR project was the predecessor of the current FP7 **WeNMR** project, a worldwide e-infrastructure for NMR and structural biology. The objective of WeNMR is to optimise and further extend the e-infrastructure developed under the e-NMR project. WeNMR will consolidate the operation of the current services and provide an e-infrastructure platform and structural biology gateway towards EGI for the users of existing infrastructures. It will build bridges to other areas of structural biology, such as SAXS, cryo-EM, X-ray crystallography, and will thus serve all relevant Instruct communities. From an e-infrastructure viewpoint, WeNMR will strengthen the European ties with National Grid Initiatives, the new EGI and PRACE initiatives toward an effective sharing of the offered service. Collaborations will be established with the Asian, South African, South and North American GRID initiatives, to extend and open the WeNMR gateway at global level.

- ▶ e-infrastructure project
- ▶ EUR 2 150 000 (2010-2013)
- ▶ [www.wenmr.eu](http://www.wenmr.eu)
- ▶ 8 partners, coordinated by the Universiteit Utrecht, the Netherlands



© Netherlands Proteomics Center/B. van Breukelen

FP7 also provides support to **PRIME-XS**, the Proteomics Research Infrastructure Maximising knowledge EXchange and access. This project brings together and coordinates the key proteomics infrastructures in Europe, plus a network of associated academic and industrial stakeholders. The overall objective of PRIME-XS is to establish and maintain a top-quality infrastructure for high-throughput proteome analysis. The project in particular provides access to versatile state-of-the-art mass spectrometers and bioinformatics infrastructure as well as to high quality specific expertise available at the research infrastructures.

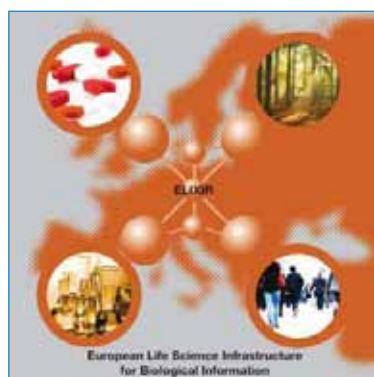
- ▶ Integrating activity project
- ▶ EUR 7 800 000 (2011-2015)
- ▶ [www.primexs.eu](http://www.primexs.eu)
- ▶ 12 partners, coordinated by the Universiteit Utrecht, the Netherlands

A last project in this field of research infrastructures is **ERA-Instruments**, Infrastructure Funding in the Life Sciences which was aiming at harmonising and coordinating research infrastructure funding within the EU. For this purpose, the project brought together ministries, charities, funding agencies and research councils active in the funding of life science research infrastructures. It provided a platform for developing policies on instrumentation, in particular in the fields of bio-analytics, NMR, mass spectrometry, microscopy, and microarray platforms.

- ▶ ERA-Net project
- ▶ EUR 1 199 911 (2008-2011)
- ▶ [www.era-instruments.eu](http://www.era-instruments.eu)
- ▶ 16 partners, coordinated by the Deutsche Forschungsgemeinschaft, Germany

## Bioinformatics resources

Bioinformatics resources are tools based on computer technology for the storage, the management and the analysis of biological data. They in particular include tools for analysing biological macromolecules for molecular biology applications, such as databases for publicly available sequences of DNA, RNA and protein; databases for pattern identification, characterisation and predicting function; or tools for finding and aligning sequences. These tools are crucial for all facets of life sciences, from health to biotechnology and agriculture, but also for other domains such as energy and the environment. A major current challenge is the exponential growth of data generated by high-throughput technologies, such as sequencing, to be archived, curated and exploited.



*Interactions within the European Life-Science Infrastructure for Biological Information*

In this field of research infrastructures, ESFRI identified one priority project (in its 2006 Roadmap), **ELIXIR**, the European life-science infrastructure for biological information. ELIXIR will construct and operate a sustainable infrastructure for biological information in Europe to support life science research and its translation to medicine and the environment, the bio-industries and society. ELIXIR will be built as an infrastructure distributed across several sites hosted by centres of excellence throughout Europe ('ELIXIR nodes'), these sites being connected to a central hub ('ELIXIR hub') located at the European Bioinformatics Institute (outstation of the European Molecular Biology Laboratory), in Hinxton, United Kingdom.

FP7 provided support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

It was agreed during the preparatory phase that Member States that support ELIXIR, and the EMBL as the host of the ELIXIR hub, will sign an international consortium agreement (ICA), establishing ELIXIR as a 'special project' of EMBL. It is also expected that nodes shall be funded by Member States and will be legal entities capable of entering into binding agreements and funding.

- ▶ Preparatory phase project
- ▶ EUR 4 500 000 (2007-2012)
- ▶ [www.elixir-europe.org](http://www.elixir-europe.org)
- ▶ 32 partners, coordinated by the European Molecular Biology Laboratory (EMBL)



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ELIXIR is also supported indirectly through additional FP7 projects. A first project is **SLING**, for Serving life-science information for the next generation. Its goal is to make sure that advances in European science are supported by the best possible bio-molecular information, and that European scientists are optimally equipped to exploit it. To do this it makes available a comprehensive range of databases and services from the Swiss Institute of Bioinformatics and the European Bioinformatics Institute. It provides extensive, high-quality training in the use of these databases to be delivered in numerous

European locations. It carries out R & D necessary to enable the data and services. The work to ensure the quality of the data will include efforts targeted at information in patent literature through the European Patent Office. New high-throughput methods such as next-generation DNA sequencing will provide major stimuli for the R & D work of the project. This integrating activity project started on 1 March 2009, continuing previous efforts under FP6.

- ▶ Integrating activity project
- ▶ EUR 8 799 969 (2009-2012)
- ▶ [www.sling-fp7.org](http://www.sling-fp7.org)
- ▶ 5 partners, coordinated by the European Molecular Biology Laboratory

A second FP7 project is **Impact** for Improving protein annotation and coordination through technology. The project contributed to the further development and enhancement of the 'InterPro' database of predictive protein signatures, i.e. entities that are used to recognise a particular domain or protein family, and its other contributing databases. Protein families and domains are indeed important pointers that help biologists to find distantly related proteins and to predict their functions.

- ▶ e-infrastructure project
- ▶ EUR 3 000 000 (2008-2010)
- ▶ [www.ebi.ac.uk/impact](http://www.ebi.ac.uk/impact)
- ▶ 8 partners, coordinated by the European Molecular Biology Laboratory

Very importantly, FP7 now also supports the **BioMedBridges** project, Building data bridges between biological and medical infrastructures in Europe. The BioMedBridges consortium brings together the six under-implementation ESFRI infrastructures (ELIXIR, BBMRI, EATRIS, ECRIN, InfraFrontier and Instruct). The project will identify and implement standard interoperable services to allow the linking, exchange and deposition of large volumes of data from one infrastructure to another, across the biological and biomedical domain. Public data will be freely accessible through these standard interoperable services. Also, standards for secure and restricted access will be identified and implemented where projects need to share sensitive data (medical information or data with intellectual property issues).

- ▶ Implementation phase project
- ▶ EUR 10 490 000 (2012-2015)
- ▶ [www.biomedbridges.eu](http://www.biomedbridges.eu)
- ▶ 21 partners, coordinated by the European Molecular Biology Laboratory

In addition, ESFRI identified another priority project (in its 2010 Roadmap), **ISBE**, the Infrastructure for Systems Biology Europe. ISBE will build an infrastructure made up of (1) readily accessible repositories for storing and archiving data and models, (2) scientific centres of excellence in systems biology providing analytical technologies (e.g. proteomics, metabolomics, genomics, etc.) and/or computational biology, modelling and informatics, (3) real-time connections between these components and with the systems biology research groups across Europe.

FP7 provides support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

- ▶ Preparatory phase project
- ▶ EUR 4 746 000 (2012-2015)
- ▶ <http://isbe.eu>
- ▶ 23 partners, coordinated by the Imperial College of Science, Technology and Medicine, United Kingdom

Lastly, the project **Cosmos**, Coordination of Standards in Metabolomics will bring together European data providers to set and promote community standards that will make it easier to disseminate metabolomics data through life science e-infrastructures. Metabolic processes drive physiology, and the use of metabolomics in environmental science, toxicology, food and medicine is well established and growing rapidly. The large amounts of data produced in metabolomics studies require robust biomedical and life science e-infrastructures. In addition to capturing and storing extremely large volumes of data, e-infrastructures must be capable of disseminating these data based on open and widely accepted community standards. The project will develop policies to ensure that metabolomics data is encoded in open standards; tagged with agreed metadata; supported by open source data management and capturing tools; disseminated in open-access databases; supported by vendors and publishers; and properly interfaced with data in other biomedical and life science e-infrastructures. The new project is well timed, as it coincides with the growing support for life science e-infrastructures such as **ELIXIR**, **EU-OPENSOURCE** and **BBMRI**.

- ▶ e-infrastructure project
- ▶ EUR 1 960 000 (2012-2015)
- ▶ [www.cosmos-fp7.eu](http://www.cosmos-fp7.eu)
- ▶ 14 partners, coordinated by the European Molecular Biology Laboratory

## Medical research facilities

Medical research is the basic research, applied research, or translational research conducted to support knowledge in the field of medicine. Medical research includes the evaluation of new treatments for both safety and efficacy through clinical trials, and all other research that contributes to the development of new treatments. Preclinical research aims specifically to elaborate knowledge for the development of new therapeutic strategies. A new paradigm to biomedical research is translational research, which focuses on iterative feedback loops between the basic and clinical research domains to accelerate knowledge translation from the bedside to the bench, and back again. Medical research facilities may allow doing research on public health, biochemistry, clinical research, microbiology, physiology, oncology, surgery and research on many other non-communicable diseases such as diabetes and cardiovascular diseases.

### High security laboratories at bio-safety level 4 (BSL4)



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ESFRI identified one priority project (in its 2008 Roadmap), **Erinha**, the European Research Infrastructure on Highly Pathogenic Agents. The planned research infrastructure will offer access to high security laboratories (BSL4) and services to face any pandemic outcome from emerging and re-emerging infectious diseases, which is a scientific challenge that implies the study of level 4 pathogens. It will offer a world level service supporting

(i) strong development of therapeutics means and diagnosis tools, (ii) harmonised bio-safety and bio-security procedures, (iii) efficient management of biological resources, (iv) training capacities, and (v) global coordination capacities.

FP7 provides support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

- ▶ Preparatory phase project
- ▶ EUR 3 600 000 (2010-2013)
- ▶ [www.erinha.eu](http://www.erinha.eu)
- ▶ 20 partners, coordinated by the Institut National de la Santé et de la Recherche Médicale (Inserm), France

## Translational research facilities



*EATRIS is speeding up the process of translational research in Europe*

In this field of research infrastructures, ESFRI identified one priority project (in its 2006 Roadmap), **EATRIS**, the European Advanced Translational Research Infrastructure in Medicine. EATRIS aims at advancing translational science in Europe by providing a research infrastructure to allow a faster and more efficient transfer of research discoveries into new products to prevent, diagnose or treat diseases, such as cardiovascular diseases, cancer, metabolic syndromes, brain disorders, and infectious disorders. EATRIS will facilitate access to research and development facilities and translational know-how for all

scientists and researchers in Europe. Facilities and services will be organised around core technology areas, named 'Product Groups', for vaccines, imaging and tracers, biomarkers, advanced therapy medicinal products and biologics, and small molecules. Each product group is composed of several centres with the necessary expertise and cutting edge infrastructure and services.

FP7 provided support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

EATRIS is to be established as an ERIC legal entity. An ERIC application has been submitted to the European Commission in 2012. A decision by the Commission is expected before summer 2013.

- ▶ Preparatory phase project
- ▶ EUR 4 200 000 (2008-2010)
- ▶ [www.eatris.eu](http://www.eatris.eu)
- ▶ 20 partners, coordinated by the Helmholtz-Zentrum für Infektionsforschung GmbH, Germany



*Vaccines for Europe and the rest of the world*  
© iStockphoto

Complementary to the support to EATRIS, FP7 provides support to **TRANSVAC**, the European network of vaccine development and research. TRANSVAC's objective is to implement a research infrastructure for early vaccine development in Europe. TRANSVAC aims to accelerate the development of promising vaccine candidates by bridging the gap between bench research and clinical trials through the provision of expertise on e.g. antigen discovery, formulation, *in vivo* models and antigen production. The project offers access to adjuvants, to vaccine preclinical testing services, to expression analysis and to immunoassays and reagents. The project supports research activities to improve these services, as well as process development and GMP manufacture, develop novel adjuvant formulations, protein production know-how, molecular tools, vaccine testing models, and functional assays.

- ▶ Integrating activity project
- ▶ EUR 9 899 999 (2009-2013)
- ▶ [www.transvac.org](http://www.transvac.org)
- ▶ 13 partners, coordinated by the European Vaccine Initiative (EVI)

Translational research facilities are also addressed by another project, **Euripred**, currently under negotiations for FP7 funding. Euripred, European Research Infrastructures for Poverty Related Diseases aims at coordinating and integrating international resources into a single specialised infrastructure to support European research on HIV infection, tuberculosis, and malaria, from early drug, vaccine and microbicide discovery to clinical trials. EURIPRED will serve as a critical and accessible biological and data resource and will facilitate international data exchange between scientific communities.

## Clinical research facilities



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In this field of research infrastructures, ESFRI identified one priority project (in its 2006 Roadmap), **ECRIN**, the European Clinical Research Infrastructures Network. ECRIN aims at creating a distributed infrastructure offering information, consulting and services to investigators and sponsors in the preparation and in the conduct of multinational clinical studies, for any category of clinical research and in any disease area. This is especially relevant for investigator-initiated or small and medium enterprise-sponsored clinical trials, as well as for clinical

research on rare diseases where international cooperation is a key success factor. ECRIN will connect coordinating centres for national networks of clinical research centres, clinical trials units, and biotherapy facilities in Europe, able to provide support and services to multinational clinical research. This distributed infrastructure will provide services such as interaction with competent authorities and ethics committees, support with insurance contracting, recruitment and evaluation of trial sites, data management, adverse event reporting, monitoring, etc. By doing so, it will provide a harmonised framework for the conduct of multinational clinical trials throughout Europe, essential for therapeutic innovations, and will help in making Europe a single area for clinical studies and take advantage of its population size to access patients.

FP7 provided support to the preparatory phase in order to address all key issues (i.e. technical, legal, governance, and financial) necessary to move towards the implementation of this new research infrastructure.

In 2011, France submitted an application to the European Commission for establishing ECRIN as an ERIC legal entity. In this application, members are France, Germany, Spain and Italy. The application is in its second phase of processing, i.e. collecting the signatures from Member States. A Decision by the European Commission is expected by September 2013.

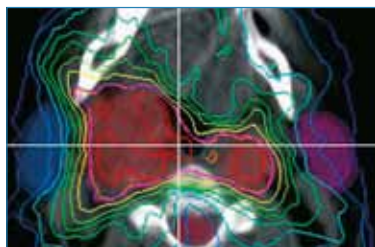
- ▶ Preparatory phase project
- ▶ EUR 5 800 000 (2008-2011)
- ▶ [www.ecrin.org](http://www.ecrin.org)
- ▶ 20 partners, coordinated by the Institut National de la Santé et de la Recherche Médicale (Inserm), France



ECRIN is now also supported by an FP7 integrating activity project, **ECRIN-IA**, the European Clinical Research Infrastructures Network — Integrating Activity. The project will promote pan-European expansion to nine new countries. It will support the services for multinational clinical trials on rare diseases, medical device and nutrition. It will also develop tools for risk-adapted monitoring and will upgrade data management tools.

- ▶ Integrating activity project
- ▶ EUR 8 000 000 (2012-2015)
- ▶ [www.ecrin.org](http://www.ecrin.org)
- ▶ 33 partners, coordinated by the Institut National de la Santé et de la Recherche Médicale (Inserm), France

## Hadron therapy facilities



In this field of research infrastructures, FP7 provides support to **ULICE**, the Union of Light-ion Centres in Europe. ULICE is a project to respond to the need for greater access to hadron-therapy facilities for particle therapy research. The project will provide access to the European hadron research facilities in Heidelberg, Germany, and Milan, Italy. Future facilities like MedAustron, Etoile and Archade participate in ULICE, which will result in a strong integrated network. Also, the project aims at

developing instruments and protocols: a new gantry design, improvement of four-dimensional particle beam delivery, adaptive treatment planning, a mechanism for patient selection to the whole European Union, and database development for specific tumours which can best be treated using carbon ion.

- ▶ Integrating activity project
- ▶ EUR 8 399 996 (2009-2013)
- ▶ <http://cern.ch/ulice>
- ▶ 20 partners, coordinated by the Fondazione Centro Nazionale di Adroterapia Oncologica — Fondazione Cnao, Italy

# Food and agriculture research facilities

Agricultural research refers to a wide range of scientific disciplines and research issues much wider than those directly related to food production (it includes for example non-food products, nutrition and health, forestry, natural resources management, landscape management, rural development, agricultural economics, etc.). The agri-food sector in Europe is facing important challenges such as the adaptation to and mitigation of climate change, food security (linked to the growing population and the change in food consumption patterns), energy security (linked to the scarcity of fossil fuel and bioenergy development), biodiversity and natural resource management (including soil and water), food safety (including animal/human health and animal welfare) and nutrition (obesity and malnutrition). It is now recognised that coordinated efforts are needed to help the scientific community to cope with these challenges. Several new research infrastructure projects have been initiated under FP7, as a new coverage when compared to FP6.

## Plant research facilities and resources



*'Root Carousel': small plants are grown in Petri dishes which are moved to a camera for a quantitative assessment of root growth and structure.*  
© Forschungszentrum Jülich

In this field of research infrastructures, FP7 provides support to **EPPN**, the European Plant Phenotyping Network. While significant progress has been made in molecular and genetic tools for plant breeding in recent years, the quantitative analysis of structure and function of plants, i.e. plant phenotyping, has become a major bottleneck. The aim of this project is to bring together the leading plant phenotyping facilities in Europe. The project will provide high throughput whole plant phenotyping access to user communities in plant sciences. It will also adapt and develop novel sensors and methods/assays for application in plant phenotyping.

- ▶ Integrating activity project
- ▶ EUR 5 000 000 (2012-2015)
- ▶ [www.plant-phenotyping-network.eu/](http://www.plant-phenotyping-network.eu/)
- ▶ 14 partners, coordinated by the Forschungszentrum Jülich GmbH, Germany



Phenotyping robot for water relation studies in trees (INRA-Nancy) © INRA / C. Buré

Complementary to EPPN, FP7 also support activities dedicated to trees and tree breeding, with the **TREES4FUTURE** project, Designing trees for the future. TREES4FUTURE will integrate major, yet rarely interacting forestry communities (and their resources) from geneticists to environmentalists and from communities working at the tree/population scale to those working at forestry landscape/wood basin levels as well as industry concerns. The long-term objective of TREES4FUTURE is to provide the whole European forestry community, with an easy and comprehensive access to complementary

sources of information and expertise to optimise the short and long-term exploitation of the forest resources by both the research community and the socioeconomic players. TREES4FUTURE will contribute in helping the European forestry sector respond, in a sustainable manner, to increasing demands for wood products and services (among which preservation of forest biodiversity) in a context of changing climatic conditions.

- ▶ Integrating activity project
- ▶ EUR 7 000 000 (2011-2015)
- ▶ [www.trees4future.eu/](http://www.trees4future.eu/)
- ▶ 28 partners, coordinated by the Institut National de la Recherche Agronomique, France

FP7 also supports an e-infrastructure project focused on plant genomic data: **transPlant**, Transnational Infrastructure for Plant Genomic Science. Compared with vertebrate genomes, plant genomes may be large and have complex evolutionary history, which makes their analysis difficult. Issues include genome size, polyploidy, and the quantity, diversity and dispersed nature of data in need of integration. To address these issues, transPLANT will build new repositories and develop new algorithms for plant genomic data. It will develop a set of computational and interactive services to the plant research community. A series of training workshops will also educate the community in the use of transPLANT tools and data. The project will be built on standard technologies for data exchange and representation, service provision, virtual compute infrastructure, and interface development; where such standards are currently lacking (as in phenotype description), they will be developed in the context of the project.

- ▶ e-infrastructure project
- ▶ EUR 4 350 000 (2011-2015)
- ▶ [www.transplantdb.eu](http://www.transplantdb.eu)
- ▶ 11 partners, coordinated by the European Molecular Biology Laboratory

## Animal quarantine stations



In this field of research infrastructures, FP7 provides support to **NADIR**, the Network of Animal Disease Infectiology Research Facilities. NADIR brings together 14 animal experiment infrastructures with bio-safety level 3, required to study the large majority of zoonoses, emerging diseases and a number of other animal infectious diseases. The project organises these European facilities in order to optimise the access to the facilities, to optimise their investigation and diagnostic/validation tools, to achieve economies of scale and to coordinate the upgrading of the existing facilities.

- ▶ Integrating activity project
- ▶ EUR 7 495 313 (2009-2013)
- ▶ [www.nadir-project.eu](http://www.nadir-project.eu)
- ▶ 16 partners, coordinated by the Institut National de la Recherche Agronomique, France

## Aquaculture research facilities



*Nofima Averøy research station, Norway. © Nofima*

In this field of research infrastructures, FP7 provides support to **AQUAEXCEL**, the AQUAculture infrastructures for EXCELlence in European Fish research. The project integrates the highest class aquaculture research facilities in Europe. It will cover the entire range of production systems (recirculation, flow-through, cage, hatchery and pond systems), environments (fresh-water and marine, cold and warm water), scales (small, medium and industrial scale), fish species (salmon, trout, sea bass, sea bream, cod, carp, etc.), and fields of expertise (nutrition, physiology, health and welfare, genetics, monitoring and management technologies and engineering).

- ▶ Integrating activity project
- ▶ EUR 9 000 000 (2011-2015)
- ▶ [www.aquaexcel.eu](http://www.aquaexcel.eu)
- ▶ 17 partners, coordinated by the Institut National de la Recherche Agronomique, France

# Livestock management

**ERIN** is a support study for the identification of potential needs and possibilities for an integrated European infrastructure network of animal facilities in ruminant physiology and breeding. This support action aimed at identifying potential European networks of animal facilities for research on large animals that will support future research needs in this area. Its objectives were to identify future needs for experimental research on large animals, to locate and characterise European experimental facilities and identify those that are candidates for forming an integrated infrastructure and to combine future needs and potential research facilities in order to produce potential scenarios of organisation.

- ▶ Coordination and support action
- ▶ EUR 460 000 (2008-2010)
- ▶ 6 partners, coordinated by the Institut National de la Recherche Agronomique, France

**European Commission**

**Enabling science**

**EU support to research infrastructures in the life sciences**

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A number of research infrastructures dedicated to life sciences are currently being developed in Europe through the cooperation of Member States with strong support by the European Commission. The European research policy is also encouraging the opening of major European research infrastructures to all researchers, on the basis of scientific excellence. The EU supports networks of infrastructures involving a large scope of facilities ranging from medical research facilities to biological resource centres. It also includes genomics and proteomics research facilities, as well as bioinformatics resources. In the field of food and agriculture, the EU action supports plant research facilities, aquaculture and animal quarantine stations.

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