Meeting Europe's Challenges:

The Role and Importance of Biological and Medical Sciences Research Infrastructures

Published by:

BBMRI
Biobanking and Biomolecular Resources Research Infrastructure

EATRIS
European Advanced Translational Research Infrastructure in Medicine

ECRIN
European Clinical Research Infrastructures Network

erinha
European Research Infrastructure on Highly Pathogenic Agents

ELIXIR

EMBRC
EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

EU-OPENSCREEN
ESFRI ROADMAP 2008

EURO-BIOIMAGING

Infrafrontier

INSTRUCT

ESFRI

SEVENTH FRAMEWORK PROGRAMME

All 10 ESFRI BMS research infrastructures receive preparatory phase funding under the 7th Framework Program of the European Union.

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Executive Summary

Framework for the Biological and Medical Sciences Research Infrastructures' Discussion Process

Our European society is facing mounting challenges, such as global warming, tightening supplies of energy, water and food, an ageing population, ballooning public health expenditures, and the rising risk of pandemics including those caused by bio-terrorism. All of these **Grand Challenges** are inter-related and a concerted pan-European effort is needed to tackle them in an integrated way. Europe has to find the means to do so, and it has to do it fast.

The European Research Area (ERA) is a key component of the EU's Strategy to respond adequately to these challenges. The Biological and Medical Sciences (BMS) initiative is a constituent pillar of plans to realize the ERA by providing world-leading research infrastructures in a field of growing economic and societal importance.

Biological and Medical Sciences Research Infrastructures (BMS RIs) will provide an interdisciplinary, innovative environment where world-leading scientists conduct top-level research and employ cutting-edge technologies. These will help to generate the new knowledge in the Biological and Medical Sciences that Europe needs in order to respond effectively to the Grand Challenges. The knowledge generated will be transformed into technical and industrial developments and will provide tools for concerted EU-policies and coordinated actions.

To capitalize on this opportunity, specific support is required. The European Parliament, the European Commission and the Council of Ministers are therefore invited to:

- Use their competencies within the European decision making processes to support the implementation of research infrastructures in Biological and Medical Sciences across relevant initiatives in the areas of health, environment, industry and research policy
- Ensure that the BMS RIs and their role in meeting the Grand Challenges are adequately taken into consideration in the implementation of the Europe 2020 strategy
- Develop a mechanism at European level for sustainable support of distributed BMS RIs
- Explore opportunities for providing tailored EU-level funding instruments for the construction, operation, and provision of user access to, BMS RIs
- Ensure that the Eighth Research Framework Programme (FP8) contains a mechanism for the sustainable funding of BMS RI in their construction and operation phase (e.g. for user access and further technology development)

The Need for Biological and Medical Sciences Research Infrastructures

The EU's ageing population means certain diseases, such as cancer, metabolic, degenerative and cardiovascular diseases are growing in prevalence. The resulting increases in healthcare expenditure put the sustainability and viability of the EU's healthcare systems under pressure.

Part of the EU's role in health is to coordinate and respond rapidly to emerging global health threats, such as pandemics, bioterrorism, and physical and biological incidents. Beyond health, the growing demands for food, water and energy top most political agendas world-wide. Europe urgently needs to address these **Grand Challenges**[1] (Box 1) before they have negative effects on the everyday life and well-being of European citizens.

Furthermore, the world economy is changing rapidly and increasing global competition requires constant renewal of European industry through research and innovation. Strong EU-based biomedical research is essential for the competitiveness of European biotechnology, pharmaceutical and healthcare industries. It is imperative that the EU creates an infrastructure environment conducive to innovation in the public and private sectors.

To address these growing challenges and pressures in an effective and successful

The Lund declaration of 2009[1] states that:

> *„The global community is facing Grand Challenges. The European Knowledge Society must tackle these through the best analysis, powerful actions and increased resources."*

and

> *"that meeting the Grand Challenges also requires …the creation and maintenance of world class research infrastructures in Europe…"*

The **Grand Challenges** include: global warming, tightening supplies of energy, water and food, an ageing population, ballooning public health expenditures, and the rising risk of disease pandemics.

Box 1: The Lund declaration was developed by scientists and calls upon the Council of the European Union and the European Parliament in partnership with the European Commission, to develop a coordinated response to these Grand Challenges.

manner, strong research-driven insights will be required. Europe will only be able to develop these insights if the right research infrastructures are in place. For the Biological and Medical Sciences, the European Roadmap for Research Infrastructures[2], published by the European Strategy Forum for Research Infrastructures (ESFRI, see *Annex*) has identified 10 research infrastructures which are essential to realize Europe's potential to meet the **Grand Challenges** (see Table 1).

Delivery and operation of these 10 Biological and Medical Sciences Research Infrastructures (BMS RIs) will overcome the fragmentation of the European research landscape and will provide researchers with state-of-the-art technologies and world-class research facilities. Ensuring *open access* across all BMS RIs will enable scientists to conduct and share cutting-edge research.

Implementation of the BMS RIs would generate momentum across more than 1000 institutions and 2.000.000 researchers from more than 36 ESFRI Member States and Associated Countries, and act as a major catalyst for realization of the European Research Area (ERA). This initiative will provide access to essential infrastructure across Europe, allowing the full potential of research in all countries across the ERA to be realized and to propel Europe to the forefront of Biological and Medical Science research globally, while simultaneously improving Europe's competitiveness in the BMS and health-related economies.

As mentioned above, BMS RIs will overcome the fragmentation of the European biological and medical sciences research landscape and provide researchers access to world-class research facilities. Each of the BMS RIs, separately or jointly, addresses each of the following challenges in several ways (see Figure 1). Here, some exemplary aspects for each BMS research infrastructure are highlighted:

Ageing societies and public health: A major task in providing efficient healthcare to European citizens is to improve current disease prevention opportunities and therapies. The scientific advances of the last century yielded powerful therapeutics such as penicillin and polio vaccine. The BMS RIs will provide cost effective platforms on which to construct new therapeutics and deliver personalized medicine.

Biological resources such as human biological samples (e.g. cells, tissues and derived biomolecules) that are linked with medical data are the essential raw material for the advancement of biotechnology, human health and research and development in life sciences. A Biobanking and Biomolecular Resources Research Infrastructure (**BBMRI**) will sustainably develop these resources and related technologies, properly addressing Europe's heterogeneous ethical and legal frameworks. Phenotyping and archiving tens of thousands of mouse disease models (**Infrafrontier**) will offer novel insight in the functional basis of human disease and place Europe in a leading position in the worldwide competition for resources and knowledge in biological and medical sciences.

The 10 Biological and Medical Sciences Research Infrastructures

BBMRI	Biobanking and Biomolecular Resources Research Infrastructure
EATRIS	European Advanced Translational Research Infrastructure in Medicine
ECRIN	European Clinical Research Infrastructures Network
ELIXIR	European Life Science Infrastructure for Biological Information
EMBRC	*European Marine Biological Resource Centre*
EU-OPENSCREEN	*European Infrastructure of Open Screening Platforms for Chemical Biology*
Euro-BioImaging	*European Biomedical Imaging Infrastructure*
ERINHA	*European Research Infrastructure on Highly Pathogenic Agents*
Infrafrontier	European Infrastructure for Phenotyping and Archiving of Model Mammalian Genomes
INSTRUCT	An Integrated Structural Biology Infrastructure for Europe

Table 1: Of 10 BMS RIs, six were included in the ESFRI Roadmap 2006 and received EC funding for their preparatory phases, which end for those initiatives during 2010/2011. *New RI initiatives added to the updated Roadmap in 2008 which will receive EC funding for the Preparatory Phase in 2010/11.*

Drug development will become more efficient by avoiding the high attrition rate in the drug development process which directly translates into costs which are passed on to be covered by healthcare providers. These goals can be achieved by i) better understanding of the molecular basis of diseases and how this relates to the genetic makeup of patients as well as its interaction with life-style and environmental factors, ii) improving diagnosis of diseases, iii) providing new drugs and medicines, and iv) improving the testing of new drugs in patients for safety and efficacy. The continued strength of the pharmaceutical industry within Europe will require sustainable access to cutting edge infrastructure.

An integrated structural biology infrastructure for Europe (**INSTRUCT**) addressing structural knowledge of biological components at different resolution levels in specific cellular contexts will underpin these goals and engage with the pharmaceutical and biotechnology industries; for example, the structure-related drug development programs that led to the discovery of the current front-line drugs used against influenza virus. Open European screening platforms (**EU-OPENSCREEN**) aiding the development of bioactive small molecules will boost the identification, characterization and optimization of chemicals for the drug development chain, the improvement of food production, biomedical imaging and diagnostic assays in the prevention and treatment of emerging and known diseases. Cutting-edge imaging technologies (**Euro-BioImaging**) will provide support to all fields of biological and medical sciences to increase knowledge and quality of healthcare. Research infrastructures for biomedical imag-

ing technologies will secure the European lead in biomedical imaging technologies, train future professionals and be drivers for innovation and technology transfer. Research infrastructures for translational research in medicine (**EATRIS**) and clinical trials (**ECRIN**) will orchestrate and significantly accelerate the process of therapy and diagnostics development, thereby fostering European competitiveness in the pharmaceutical, imaging, biotechnology and medical devices industries and providing solutions for healthcare of e.g. an ageing population.

Pandemics, security and globalization: In addition to their own domestic problems, all countries must now deal with these internationally transferable risks. These new challenges are demanding novel forms of international cooperation, which, if developed, may also help to reconcile general national self-interest with international mutual interest. Climate change, increasing populations and increased mobility are major factors leading to the emergence within Europe of new pathogens (e.g. Bluetongue virus) with unforeseen risks for society and the economy.

The creation of a European research infrastructure to integrate existing and newly-established high security laboratories (ERINHA) that will, through the BBMRI interface with the healthcare systems of Member States, guarantee that emerging pathogens are rapidly detected and research data can be generated that are required for a proper risk assessment to support fact-based decision making for preventive measures. The BMS RIs will provide the technologies, biobanks and knowledge to speed-up the development of diagnostic assays as well as preventive and therapeutic approaches, such as vaccines. Furthermore, the scale of damage caused in cases of bioterrorism could be markedly reduced.

Reduction in biodiversity and climate change: The influence of oceans and their ecosystems on global climate change and the environment is just emerging. It will be of utmost importance and urgency to study these interrelationships for the correct extrapolation of future climate scenarios. European marine biology facilities (**EMBRC**) will play a key role in providing a multidisciplinary and integrated research environment linking into many of the other BMS RIs.

Exponential growth of biological and medical information: Biological research is generating information at unprecedented rates, which will increase with personalized genome sequencing. **ELIXIR** will construct a sustainable infrastructure for storage and curation of biological information in Europe. It will make this data accessible to the research community, underpinning the other BMS RIs. It will address the grand challenges of: healthcare for an aging population; a sustainable food supply; competitive pharmaceutical and biotechnology industries and protection of the environment.

More details about the individual BMS RIs are provided in the *Annex*.

BMS RIs and the Grand Challenges

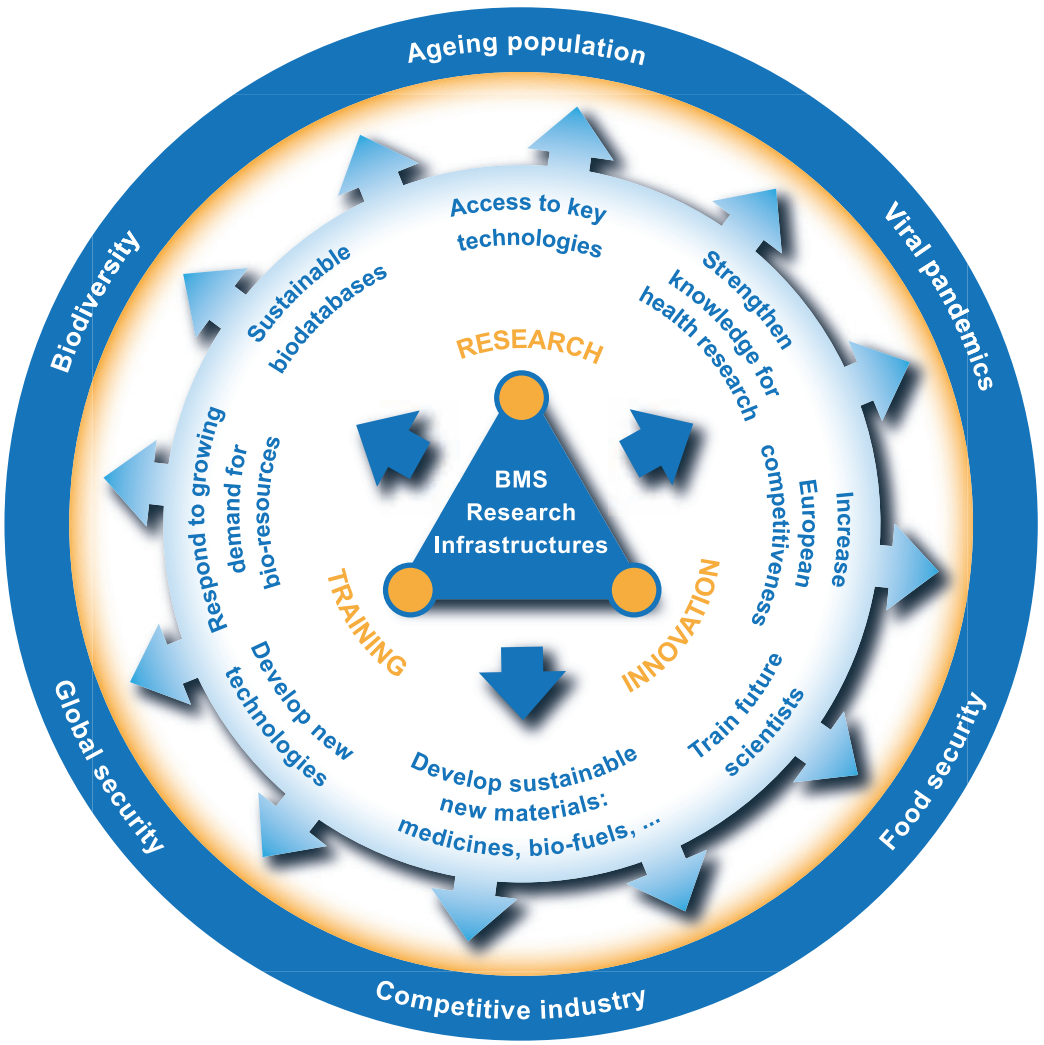

Figure 1: World-class research infrastructures, which are a key pillar of ERA, are at the core of the knowledge triangle: research activity, advanced education/training and innovation.

Sustainable Implementation of BMS RIs – Measures Required

The BMS RI initiatives on the ESFRI Roadmap are currently in different phases of planning and construction.

Preparatory Phase: All BMS RI projects (Table 1) have received or will receive Preparatory Phase funding (4.5-7 M €) each) from the European Commission for developing infrastructure construction and operation plans. At the moment, this Preparatory Phase funding of 45 M € constitutes all the financial support on a European level for BMS RI implementation.

Construction and Operation Phases: The construction, operation and maintenance of BMS RIs, which are of the order of 100-1000 M € construction costs and 2-150 M € operation costs/research infrastructure/year, for the time being mainly relies on funding by Member States. Sustainable funding for operational costs is especially crucial as these costs will be relatively high compared to construction costs and will accumulate over the lifetime of the research infrastructure. Several Member States have already ranked one or more BMS RIs as a high priority in their national roadmaps and have committed significant funding for construction.

For the long-term implementation of the pan-European BMS RIs it will be of key importance to establish sustainable funding instruments in addition to those already committed by some Member States. Common European benefits will be the key drivers in decision making around RI implementation. This is especially important for BMS RIs, as in most cases they will be distributed across several Member States.

To guarantee sustainable implementation of BMS RIs as a key pillar of the ERA and to secure Europe's competitiveness, the current funding must be complemented by new Europe-wide, EU-level funding instruments that are tailored to the needs, organizational structure and strategic relevance of BMS RIs.

We therefore call upon the European Parliament, the European Commission and the Council of Ministers to act as driving forces in the realization of the ERA by using their influence and power to support initiatives considered essential for the implementation of BMS RIs as key pillars of the ERA.

The European Parliament, European Commission and the Council can support the implementation of BMS RIs based on their competencies:

- accorded to them by Article 182 in *Treaty on the Functioning of the European Union*: "… European Parliament and the Council, …, shall establish the measures necessary for the implementation of the European research area."
- in the preparation and decision on the 8th Multiannual Research and Development Framework Program (FP8).
- in proposing and adopting legislation and policy initiatives in the following areas: protection and improvement of human health, environment, industry, education, agriculture and fisheries, common safety, civil protection.

Therefore the European Parliament, the European Commission and the Council of Ministers are invited to:

- Use their competencies within European decision-making processes to support the implementation of research infrastructures in Biological and Medical Sciences across relevant initiatives in the areas of health, environment, industry and research policy
- Ensure that the BMS RIs and their role in meeting the **Grand Challenges** are adequately taken into consideration in the implementation of the Europe 2020 strategy
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It is now of utmost importance to maintain the unique momentum for BMS in Europe. Any delay or halting of the implementation process would have profound negative consequences for Europe's competitiveness and potential to respond to the **Grand Challenges**.

Annex

1. BMS RIs are a key pillar of the European Research Area

Since 2000, the European Research Area (ERA) has worked to create a unified European research and innovation market, equivalent to the European "common market" for goods and services[3]. Implementation of the ERA will transform the EU into a leading knowledge-based society, boost European competitiveness globally and help integrate the various European research initiatives.

The goal of the ERA is to enable researchers to move freely around Europe, interact seamlessly, and acquire the knowledge we need to address the Grand Challenges. To deliver this objective it is essential to establish sustainable pan-European Biological and Medical Sciences Research Infrastructures, as defined in the ESFRI roadmap. This, in turn, requires the mobilization of resources and the involvement of all relevant stakeholders. The BMS RIs are a key pillar of the ERA, which sits at the core of the knowledge triangle of research activity, advanced education/training and innovation.

The Competitiveness Council recognized at its meeting on 3 December 2009 that:

"Europe, in order to respond adequately to its grand challenges … must continue increasing support for research and research-based innovation …."

and

"… A limited set of ambitious quantitative and qualitative targets, should be considered …for competitiveness and growth and the implementation of ERA, reflecting the reaffirmed commitment to transforming the EU into a leading knowledge-based society."

Box 2: Council of the European Union – Council conclusions on the Guidance on future priorities for European research and research-based innovation in the post-2010 Lisbon strategy [4].

2. The ESFRI Process

The European Strategy Forum for Research Infrastructures (ESFRI) represents the Member States' research ministries and the European Commission. ESFRI was established in April 2002 to produce the "European Roadmap on Research Infrastructures" reflecting a common mid- to long-term strategy for European Member States. ESFRI published its first roadmap in 2006, updated it in 2008[2], and a further update will be published at the end of 2010.

ESFRI has defined research infrastructures as: "facilities, resources or services of a unique nature that have been identified by pan-European research communities as necessary to conduct top-level activities in all fields"[2]. They must apply an 'Open Access' policy for basic research, i.e. be open to all interested researchers, based on open competition and scientific excellence.

To facilitate the creation of large distributed research infrastructures with operational sites in multiple Member States, the Community legal framework for a European Research Infrastructure Consortium (ERIC) was created[5]. ERIC complements other international legal frameworks, such as European Molecular Biology Laboratory (EMBL), in establishing the ERA.

General benefits of BMS RIs for the European Research Area

Each of the BMS RIs will have an important impact on ERA and the European Society. They will be fundamental for:

- Meeting the **Grand Challenges**
- Generating opportunities to increase Europe's knowledge-based industry and competitiveness, and development or utilization of Intellectual property
- Promoting interdisciplinary research in Biological and Medical Sciences across Europe
- Harmonizing and standardizing the European research landscape
- Training and education of future professionals in research and development
- Attracting world-leading scientists to ERA ("brain gain") and retaining key expertise
- Promoting the participation of new Member States and thereby contributing to European Cohesion Policy
- Providing pan-European access to cutting edge technology platforms for academia and industry
- Increasing the application of new innovations in the biotechnology and pharmaceutical industries, as well as in agriculture and environmental protection
- Delivering important synergies resulting in a value-generating chain without gaps; rapidly translating findings from basic research to new applications

Box 3. General benefits of BMS RIs. Each of the BMS RIs will have an important impact on ERA and on European society.

3. BMS RIs' Objectives

One of the key activities of BMS RIs will be the training and education of future professionals for R&D in close cooperation with other European and global training programs such as IMI (Innovative Medicines Initiative). The harmonized BMS research infrastructure landscape creates a unique research environment which will attract world-leading researchers and experts from outside Europe to perform cutting-edge research in the ERA and reverse the brain drain of the past decades into a brain gain.

Towards an integrated BMS RI landscape

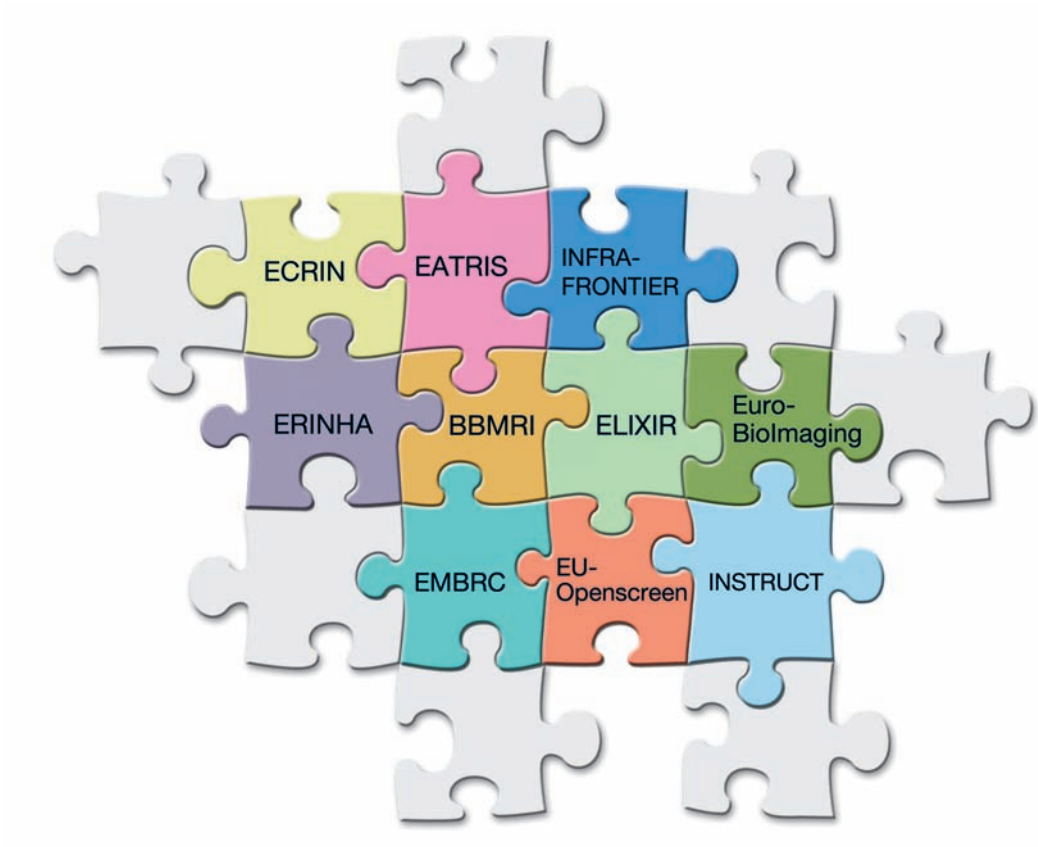


Figure 2: The 10 BMS RIs in Biological and Medical Sciences comprise complementary facilities, technologies and knowledge. The synergies of the BMS RIs will deliver important added value.

Furthermore, the coordinated approach of the BMS RIs will deliver synergies and highly interoperable processes resulting in a value-generating chain without gaps rapidly translating findings from basic research to new medicines (see Figure 2). These markedly reduced research and development timelines will result in faster publication, improved securing of intellectual property, and faster market entry of new products.

Pharmaceutical and medical diagnostics research and development is facing substantial challenges that have prompted the industry to shift from the vigorous pursuit of intellectual property towards exploration of pre-competitive cross-industry collaborations and engagement with the public domain. High-quality, open and accessible resources, data and facilities are the foundation of pre-competitive research, and strong public-private partnerships have considerable potential to enhance R&D. The BMS RIs will provide the appropriate environment to establish public-private partnerships that will enable the construction of 'expert centers'. These will provide trans-national access to high quality resources, data and expertise for academia and industry, while retaining the direct engagement of commercial interests in Europe.

Moreover, in the future ERA, the joint BMS RIs landscape will create a framework for efficient interaction of leading scientists and cutting edge technologies from various disciplines thereby facilitating the generation of ground-breaking innovation.

The 10 Biological and Medical Sciences Research Infrastructures

In the European Roadmap for Research Infrastructures[2], ESFRI has identified 10 research infrastructures in the areas of Biological and Medical Sciences which are essential to realize Europe's potential to lead the world in innovative Biological and Medical Sciences.

BBMRI

The **Biobanking and Biomolecular Resources Research Infrastructure (BBMRI)** addresses the increasing demands of accessing human biological samples and data, and biomolecular resources that are identified as key limiting resources for the advancement of medical research and related industries. The BBMRI will generate an advanced framework for the systematic investigation of biological samples, such as blood or tissues from diseased or healthy people, as well as the careful analysis of disease outcomes and effects of therapies.

BBMRI
Biobanking and Biomolecular Resources Research Infrastructure

These investigations have been the basis for our current medical knowledge but coping with the emerging challenges of providing sustainable healthcare requires a better understanding of the interaction between genes and the environmental (lifestyle) factors that contribute to disease. The BBMRI will also help determine what are effective treatments and prevention measures. In BBMRI, we have an opportunity for a Europe-wide harmonized policy on, and regulatory and ethical framework for, biobanking and data management and access.

EATRIS

The **European Advanced Translational Research Infrastructure in Medicine (EATRIS)**, will provide infrastructure allowing a faster and more efficient translation of research discoveries into new products to prevent, diagnose or treat diseases.

Translational research – the process of developing new tools or treatments to improve human health from initial discoveries – is not efficient enough. Too few findings from research make their way to the clinic. IInfrastructure and targeted support for biological and medical scientists is needed to increase the number of innovative new medicinal products.

EATRIS will offer infrastructure for all steps of the pre-clinical and early clinical development of medicinal products. It will operate through a pan-European network of leading Biological and Medical Sciences research centres, which already have the necessary facilities and expertise. These centres will form strong new innovation clusters, or EATRIS Centres. These EATRIS Centres will be opened up to all researchers for the translation of their research findings. Sharing experience and powerful translational infrastructures will lead to better healthcare provision and provide a bridge between countries of different translational capacity, making Europe more competitive.

ECRIN

The **European Clinical Research Infrastructures Network (ECRIN)**, links national networks of clinical research centres and clinical trials units. By connecting these national hubs, ECRIN is designed to bridge the fragmented organization of European clinical research and to develop an integrated EU-wide infrastructure.

ECRIN is an open-ended, pan-European infrastructure set up to provide support and services to multinational clinical research, in all medical fields and for all categories of research, while observing strict scientific, ethical and quality standards.

ECRIN provides access to clinical trial participants, strengthening the competitiveness of Europe in clinical science and making it more attractive as a destination for the development of preventive, diagnostic and therapeutic interventions.

ECRIN harmonizes training, tools and practice with high quality standards; fosters transparency and sharing of data; and promotes collaborative R&D projects. It also contributes to the organization of national infrastructures, promotes a harmonized regulatory system and shared ethical standards, and mechanisms for funding multinational clinical research projects.

ECRIN collaborates closely with established multinational clinical research groups, such as the **European Organization for Research and Treatment of Cancer** (EORTC).

ERINHA

With the emergence and re-emergence of infectious diseases involving highly pathogenic microorganisms there is a crucial need for Europe to be well prepared to face any pandemic threat. At present, there are only a few identified biosafety level (BSL) 4 laboratories available in Europe that are part of European networks. Most of the BSL4 facilities still lack global coordination, harmonized diagnosis testing, and coherent and efficient biological resource management systems, as well as training capabilities.

The main goal of the **European Research Infrastructure on Highly Pathogenic Agents (ERINHA)** is to reinforce the European capacity for studying category 4 pathogens, and to efficiently coordinate all activities related to BSL4 laboratories at the European level (research, diagnosis, biosecurity & biosafety, management and exchange of biological resources, training).

This goal will be achieved through five main actions: building additional BSL4 areas at several existing BSL4 laboratories, building new BSL4 laboratories in selected EU countries that are currently lacking one, building support infrastructures around BSL4 laboratories (mainly dedicated to hosting scientific visitors and staff), setting up user access to the infrastructure, and establishing coordination capacities for the efficient control of all activity.

The ERINHA consortium gathers relevant and complementary expertise from key partners and associated partners from 14 European countries, and will create synergies with other BMS RIs, including BBMRI, EU-OPENSCREEN, INSTRUCT, ELIXIR and Euro-BioImaging.

ELIXIR

The **European Life Science Infrastructure for Biological Information (ELIXIR)** will provide a sustainable infrastructure for storage and curation of biological information in Europe to support life science research and its translation to medicine, the environment, bio-industries and society.

ELIXIR will underpin the other ESFRI biomedical science research infrastructures, allowing Europe's research community to address the grand challenges. By linking biomedical and biological data resources, ELIXIR will facilitate understanding of disease and will drive earlier diagnosis, improved disease management and preventive strategies. ELIXIR will provide access to information on plant genomes, insect pests and plant pathogens, enabling crop researchers to develop healthier, more productive crops in the face of a rapidly growing population. ELIXIR will support our pharmaceutical and biotechnology industries by facilitating pre-competitive collaboration and attracting companies to Europe. Finally, ELIXIR will help environmental scientists to monitor life in the oceans, understand the effects of climate change on species diversity and develop new methods to tackle pollution and waste.

More powerful informatics resources and platforms are crucial to enable ELIXIR's large and diverse user community to share, analyse and interpret the huge volume of biological data generated by multi-genome sequencing projects and other data-intensive investigations into the mechanisms of life. The preservation and curation of this data offers excellent value for money: the cost of maintaining the infrastructure for a database is less than one per cent of the cost of collecting the data, and allows maximum benefit to be gained from it. ELIXIR will provide equality of access to all European researchers and will be distributed around Europe.

EMBRC

The **European Marine Biological Resource Centre (EMBRC)** is a distributed pan-European infrastructure providing access to model marine organisms and related genomic resources. It will promote access for both research and training. The main coastal marine laboratories will be embedded and complement one another within this RI, providing access to model organisms and their ecosystems, together with modern technology and 'omic' platforms.

EMBRC will allow access to study currently undefined biological mechanisms, which could in turn be used for biomedicine or biotechnology. Integrating actions between partners will involve: i) improving instrumentation for access to the biodiversity of coastal ecosystems (particularly genomic technology); ii) improving the production, maintenance, provision and utilization of key marine models for biological sciences; and iii) promoting the functional analysis of ecological and biological models, using modern 'omic' and computational-based approaches.

EU-OPENSCREEN

EU-OPENSCREEN is a distributed pan-European infrastructure built from an association of open-access screening platforms for the development of bioactive small molecules.

The broad interdisciplinary chemical-biology approach of EU-OPENSCREEN (covering all areas of the molecular life sciences) brings together chemists, engineers, informaticians and biologists, and creates numerous opportunities for basic science, innovation and commerce.

Unlike commercial screening platforms and those used by the pharmaceutical industry, EU-OPENSCREEN will mainly screen non-validated targets to identify entirely new target classes, which will dramatically broaden the basis for the commercial development of bioactive compounds.

For the first time the distributed infrastructure will offer academic European researchers access to the most advanced screening technology, which is currently only available in the pharmaceutical industry.

EU-OPENSCREEN will contribute to better protection and improvement of health, have an impact on farming and food production, and encourage and facilitate innovation, research and development in pharmaceutical, biotechnology, healthcare and agricultural areas.

EURO-BIOIMAGING

Euro-BioImaging will act as the European research infrastructure in the field of biomedical imaging. The innovation-driven nature of Euro-BioImaging facilities will strengthen Europe's leading role in developing and implementing cutting-edge imaging technologies. Through Euro-BioImaging, the provision of high quality services by one legal entity and the establishment of standardized access models to biomedical imaging technologies will foster national and European collaboration among research institutes, exchange of methods and expertise, and greatly accelerated access to emerging innovative imaging methods. Euro-BioImaging will secure state-of the art technology transfer by training future professionals in R&D and by providing comprehensive, standardized training curricula for biomedical imaging. Furthermore, Euro-BioImaging will provide top-level services to all BMS RIs allowing them to deliver world-class research based on data standardization, best practice and coordination of research activities.

Given the broad range of imaging technologies coordinated through Euro-BioImaging, the research infrastructure will facilitate the translation of basic results to medical applications, from bench to bedside. New opportunities for commercial exploitations of methods through European optical and medical device manufacturers will also be created. In this context Euro-BioImaging has already created an industry board with all leading vendors and producers of biomedical imaging equipment in Europe.

INFRAFRONTIER

Mouse models are a central tool in biomedical research. Community-driven research projects and large-scale systematic mutagenesis programs produce thousands of new disease models, but the major bottlenecks are the proper characterization (systemic phenotyping), archiving and distribution of mouse models, and making these available to the biomedical research community.

Infrafrontier

Infrafrontier integrates 18 research laboratories from Europe and Canada with exceptional track records to implement and run large cooperative research infrastructures, as well as 13 partners from research ministries, funding agencies and research councils. The Infrafrontier partners will provide access to a sustainably-funded research infrastructure for the systemic phenotyping, archiving and distribution of mouse models for human diseases.

Infrafrontier consists of two parts:

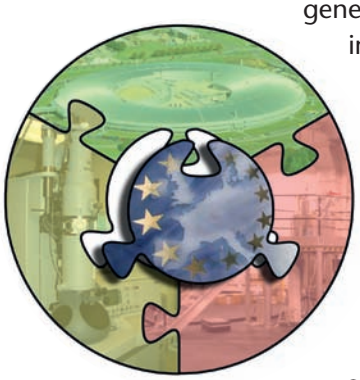
Phenomefrontier connects the major primary phenotyping centres in Europe and Canada (the mouse clinics) and will provide capacity and access to mouse model systemic phenotyping in Europe and around the globe

Archivefrontier will provide capacity for the archiving and distribution of mouse models on a sustainable basis. To achieve this, EMMA, the European Mutant Mouse Archive, will be extended and upgraded.

In 2010 the implementation of Infrafrontier as a new legal entity will be initiated. Infrafrontier will be integrated into the biomedical research infrastructure architecture of Europe. It will contribute to maintaining Europe's position at the leading edge of modelling and understanding of human health and disease.

INSTRUCT

Integrated structural biology allows us to see in atomic detail the mechanisms by which healthy cells function and diseases progress. This understanding will underpin our ability to provide new therapeutics to meet the *Grand Challenges.* Europe has a strong tradition of developing structural biology technologies and many of the major companies and research laboratories in this area are sited in Europe, as are many of the pharmaceutical and biotechnology companies which utilize structural data. A key driver of **INSTRUCT** was the impetus generated by the recent powerful technological improvements in structural studies of biological systems, such as sample production technologies and improved techniques for structure resolution. These advances are helping to illuminate the dynamic structural relationships between cellular components and to allow the further refinement of the cellular structural context.



INSTRUCT

The main objective of INSTRUCT is to establish a distributed pan-European infrastructure of high-end technologies for structure determination, providing opportunities for those otherwise unable to utilize these for important scientific projects. This will enable experts in one structural biology technology to gain expertise in complementary techniques, thereby broadening the skills base and promoting a more systems-based approach to structural biology. INSTRUCT will also offer companies the opportunity to access the best expertise in Europe in order to help develop the next generation of equipment and skilled researchers.

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