PROJECT FINAL REPORT

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Project acronym: EURO-BIOIMAGING

Project title: Euro-BioImaging - Research infrastructure for imaging technologies in biological and biomedical sciences

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[1] Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.

4.1 Final publishable summary report

4.1.1 **Executive summary (not exceeding 1 page).**

The ESFRI research infrastructure Euro-BioImaging will provide open user access to a complete range of state-of-the-art imaging technologies in biological, molecular and medical imaging for life scientists in Europe and beyond. Euro-BioImaging will offer image data support and training for infrastructure users and providers and continuously evaluate and include new imaging technologies to ensure cutting-edge services in a sustainable manner. Through Euro-BioImaging, investment in imaging infrastructure will be used in the most cost-effective and efficient way by applying the highest quality standards in management, open user access and service of imaging facilities.

The Euro-BioImaging infrastructure will consist of a set of complementary, strongly interlinked and geographically distributed Nodes in different Member States. The physical user access will take place at these Nodes. The pan-European infrastructure will be empowered by a strong supporting and coordinating entity, the Euro-BioImaging Hub. The Hub will be the single entry point from which the users will be directed to their desired imaging technology as served by the respective Euro-BioImaging Nodes. At the Hub, dedicated data management and training activities tailored to the needs of users of the imaging infrastructure will be coordinated.

During its Preparatory Phase (2010-2014), Euro-BioImaging has conducted extensive consultation with the European scientific communities, gained support by over 3000 individual Stakeholders, extensively analyzed supply and demand of imaging technologies in Europe, successfully demonstrated technical feasibility of its operational model in a six months proof-of-concept phase, has identified and evaluated possible Nodes in its Member States and has finalized recommendations for the infrastructure model, governance structure and finance plan.

By now 9 European countries listed imaging infrastructure as high priority on their national roadmaps. Euro-BioImaging has driven the establishment of 24 national imaging initiatives across Europe that are coordinating imaging infrastructure activities at the national level, enabling better use of their capacities and speak to their national funders with one voice. Furthermore, Euro-BioImaging is in close communication with the European imaging industry through the Euro-BioImaging Industry Board that to date comprises more than 50 companies. In the past years, vibrant international cooperations were established with Australian and Indian national imaging infrastructure organizations, fostering exchange of knowledge and best practice principles.

In 2013, 71 imaging centres from 19 countries responded to the 1st Europ-BioImaging open call for Nodes and submitted their Expressions of Interest. Together, these potential Nodes could serve over 2200 research projects. Based on the evaluation by an independent high level international review board, the 1st generation of potential future Nodes is currently being constructed (202 million Euro have already been invested) or is negotiating the financial support for their required capacity upgrades with national funders.

The Euro-BioImaging Memorandum of Understanding (MoU) was agreed by the Intergovernmental Working Group with delegates from 21 European countries and EMBL interested to participate in Euro-BioImaging`s implementation. So far the MoU has been signed by 12 countries (Belgium, Czech Republic, Finland, France, Israel, Italy, Norway, Poland, Slovakia, Spain, the Netherlands, UK) and EMBL. More countries are planning to join in the near future. MoU signatories have constituted the Euro-BioImaging Interim Board on 31 Mar 2014 that took on the responsibility for infrastructure implementation during the Interim Phase. The Interim Board will now invite enrolled countries to consider their interest in hosting the Euro-BioImaging Hub.

4.1.2 A summary description of project context and objectives (not exceeding 4 pages).

In 2008, ESFRI included Euro-BioImaging - the European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences – in the 2nd edition of its European Roadmap for Research Infrastructures. During the EC FP7-funded Preparatory Phase which lasted from 01 Dec 2010 until 31 May 2014, the Euro-BioImaging Consortium developed a consensus recommendation for the Euro-BioImaging infrastructure model supported by 24 national imaging chapters, 250 Associated Partners and more than 3.000 individual stakeholders.

Why Euro-BioImaging?

The technical revolution in biological and medical imaging within the last 15 years has opened the door to answer many research questions that were difficult to be addressed before. This has led to a dramatically increased demand for access to a number of imaging technologies by the scientific community, which cannot be met by the currently existing imaging infrastructure.

In most cases, researchers can only access local imaging research infrastructure hosted by their university, research institute, hospitals etc. These institutions merely provide access to a very limited range of technologies, because they can simply not afford to purchase and maintain a broad range of cutting-edge instruments, especially in times of budget financial austerity. In addition, the degree of sophistication of innovative imaging technologies and their instrumentation is often requires specialized expertise to efficiently and successfully operate and analyse obtained image data.

Thus, the currently existing local imaging infrastructure in European countries does not exploit the full potential of these technologies. Many scientists at institutions without large core facilities have only very limited or no access at all to the imaging technologies they need. Even if technologies and expertise are accessible at other European institutions, currently these facilities by far do not have the capacity to host a significant number of external users (see *Euro-BioImaging Survey*[2]). Therefore the establishment of coordinated imaging facilities offering open access to external users is urgently needed.

The goal of Euro-BioImaging is to provide a clear path of access to imaging technologies for every life scientist in Europe. Euro-BioImaging brings together key research areas in imaging technologies stretching from basic biological to medical imaging. With this broad vision of imaging, Euro-BioImaging addresses the imaging requirements of both biological and medical imaging research communities by recommending a coordinated and harmonized plan for infrastructure deployment in Europe.

Euro-BioImaging will consist of a number of distributed Nodes, which will offer access to external users to the requested imaging technology. Activities of the Nodes will be coordinated by the Euro-BioImaging Hub, ensuring a consistent level of service provided to the Euro-BioImaging users and supporting all Euro-BioImaging activities, which cannot be done at the level of a single Node. Importantly, Euro-BioImaging will flank the access to technologies with high-level expert support, training activities, as well as data storage and processing solutions, all of which were requested by European scientists and are necessary for the successful usage of the infrastructure.

The Euro-BioImaging infrastructure will tackle the standardized and high quality education of tomorrow's scientists in applying advanced imaging technologies, which is one of the big challenges in biology and medicine. The already existing lack of trained staff will become more momentous

[2] www.eurobioimaging.eu

within the next years and has also to be approached as soon as possible in order not to lose alignment in the international standard and competition.

Objectives of Euro-BioImaging Preparatory Phase

The Euro-BioImaging Preparatory Phase Consortium consisted of 13 individual Work Packages. The strategic Work Packages WP1 to WP5 realized the ambitious overarching strategic objectives such as the recommendation for the governance structure, legal model and ethical regulations (**WP2**), the Euro-BioImaging survey, Euro-BioImaging vision, impact studies and the overarching business plan (**WP3**), the finance plan and cost model (**WP4**), involvement and communication with internal and external stakeholders (**WP5**). **WP1** Project Management supported the Consortium throughout Preparatory Phase by providing the required administrative and managerial framework.

The development of the Euro-BioImaging infrastructure model was met by its five technology Work packages **WP6** to **WP10** that covered imaging technologies ranging from general advanced light microscopy, innovative ALM technologies, via molecular imaging to innovative medical imaging technologies up to population imaging. Each of these five technology Work packages first defined the needs of its user communities in the Euro-BioImaging survey and Proof-of-Concept studies and based on their identified needs, prepared the general and technology-specific criteria for construction and operation of Euro-BioImaging Nodes as published in the 1st Open call for Nodes in 2013.

Together with **WP12**, **WP6** to **WP10** developed a common user access policy valid for all Euro-BioImaging infrastructures irrespective of their specific technology they plan to offer. Similarly, **WP13** developed a plan for training Euro-BioImaging users in the specific imaging methods to allow researchers to take full advantage of the access given and the services offered. In addition, when users apply any of the imaging technologies in their research, this generates large amounts of digital image data, which creates a common need for data management, processing, and storage tools. Therefore, **WP11** developed an integrated plan for image data management methodologies and protocols, quantitative data processing.

A key objective of all Euro-BioImaging Nodes will be coordination. The Euro-BioImaging model foresees a strong European Hub as coordination platform for delivering knowledge and expertise, allowing exchange of methodologies and the joint use of acquired data. This coordination platform will serve European scientists by providing a clear path for access to advanced imaging technologies and at the same time provide the possibility for many existing imaging research institutions or laboratories to contribute to knowledge development and training.

In summary, the Preparatory Phase Consortium of Euro-BioImaging:

- Defined the needs of the biological and medical imaging user communities in a European-wide survey with more than 660 participants in 2011.
- Conducted in 2012 a six-month proof-of-concept operational phase that supported 110 user research projects in 41 Euro-BioImaging partner facilities in 14 countries, demonstrating that the Euro-BioImaging infrastructure and access models are operational and enable new research that is published in high impact peer review journals. 22 studies had been published by November 2013.
- Defined the general and technology specific criteria for construction and operation of Euro-BioImaging Nodes as published in the 1st Open Call for Nodes in 2013.
- Developed a plan for harmonized and standardized access to imaging technologies
- Developed a plan for harmonized and standardized training curricula in imaging technologies

- Developed a plan for image data management, storage and processing
- Defined recommendations for the legal and governmental framework for the construction and operational phase
- Defined a recommendation for the finance plan to support construction and operation
- Summarized the mission, services, infrastructure model, and recommendations for the governance, finance plan and legal framework in an overall business plan
- Integrated Euro-BioImaging into the European and global research infrastructure landscape.

The Euro-BioImaging preparatory phase has delivered a mature and tested research infrastructure model for imaging technologies. The model defines which imaging technologies need to be provided to Europe's researchers, through which procedure they can be made openly accessible, and which highly evaluated potential future Nodes could serve them. The Euro-BioImaging model furthermore gives a clear recommendation for how the pan-European infrastructure can be governed by its Member States and coordinated and managed by its European Hub.

Objectives of Euro-BioImaging Interim Phase

In 2013, the Euro-BioImaging Preparatory Phase Consortium facilitated the establishment of the Euro-BioImaging Intergovernmental Working Group (IWG) comprising representatives from 21 different European countries and EMBL. Together, they defined and agreed on a Memorandum of Understanding (MoU), which provides its Signatories the framework to work together towards construction of Euro-BioImaging. The MoU has been signed by 12 countries (Belgium, Czech Republic, Finland, France, Israel, Italy, Norway, Poland, Slovakia, Spain, The Netherlands, UK) and EMBL. More countries are planning to join in the near future. MoU signatories have constituted the Euro-BioImaging Interim Board on 31 Mar 2014. Taking the preparatory phase recommendations into account the Euro-BioImaging Euro-BioImaging Interim Board now works on

- Criteria for the Hub and identification of Hub-hosting country
- Governance structure
- Legal model and statutes
- Finance plan

After approval in the Interim Board, the legal model, the governance structure, and the finance model for European-level infrastructure services provided by the Euro-BioImaging Hub will be laid down in the statutes of a Legal Framework. The future Euro-BioImaging Member States will launch Euro-BioImaging by signing the Legal Framework, and at the same moment the Interim Board will hand over the decision-making power to the Euro-BioImaging Board, at which point the Interim Phase will end.