Euro-BioImaging

European Research Infrastructure for Imaging Technologies in Biological and Medical Sciences

WP3
Process Plan

Task 3.1
Vision of Euro-BioImaging

Deliverable 3.3
Update of Vision of Euro-BioImaging

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VISION PAPER

The mission of Euro-BioImaging is to provide a clear path of access to a complete range of essential imaging technologies for every biologist and medical scientist in Europe. This is the second update of the vision paper presenting the opportunity, importance, benefit, substance and implementation of Euro-BioImaging for key stakeholders such as Member States, funding agencies and decision makers.

Euro-BioImaging: Added value for Europe

ACCESS TO IMAGING TECHNOLOGIES: Euro-BioImaging will allow scientists from your country to access the full range of cutting edge imaging technologies they need for their valuable biological or medical research delivered by the best experts in the field. Euro-BioImaging will guarantee that your investment in imaging infrastructure is used in the most cost-effective and efficient way by applying Euro-BioImaging quality standards in management, access and service of imaging facilities.

TRAINING: Standardized and high quality education of tomorrow's scientists in applying advanced imaging technologies to study the single cell to the entire human being will be one of the major challenges in biology and medicine. Specific training programmes at Euro-BioImaging facilities of users as well as facility staff will complement national efforts in education and Member States will benefit from an increase in expertise.

IMAGING DATA: Biological and medical imaging will become one of the major data producers in the future and researchers are facing unprecedented challenges concerning image data management and analysis. The Euro-BioImaging infrastructure will offer platforms for storing, sharing and processing biological and medical imaging data on a large scale.

ECONOMIC VALUE: By opening access to the complete range of imaging technologies while at the same time coordinating and sharing the costs of deployment, Euro-BioImaging will allow its Member States to realize a much better and sustainable return on investment for biological and medical imaging. Implementing the Euro-BioImaging infrastructure with its Nodes in different regions of Europe will create new job opportunities and perspectives for high-potential employees, including researchers, engineers, administrative and related staff. The innovative technology development environment surrounding Euro-BioImaging Nodes will continue to stimulate the founding of new biotech and bio-optical companies across Europe, or new products from existing European companies that are currently world market leaders, both of which may commercialize newly developed imaging technologies or provide imaging related services.

EUROPEAN RESEARCH AREA: Euro-BioImaging closely cooperates with all Biological and Medical Sciences Research Infrastructures to overcome the fragmentation of the European research landscape.

What is Biological and Medical Imaging?

The last 15 years witnessed a revolution in imaging technologies, allowing biological and medical scientists to visualize, characterize and measure molecular and cellular function with a precision never reached before. For the first time in history, we can visualize the molecular basis of human diseases, including tumorigenesis, or Alzheimer's disease in living cells and tissues in real time.

For medical research, imaging includes Magnetic Resonance Imaging (MRI), X-ray Computed Tomography (CT), but also many other imaging technologies. For example, better detection of occluded blood vessels to improve the prediction of heart attack, earlier detection of growing tumours to improve the success rate in the fight against cancer, or monitoring the normal

development of a foetus during pregnancy are all dependent on medical imaging. Medical imaging can provide insight into the function and metabolism of organs allowing the visualization of the effectiveness of new targeted therapies, e.g. in cancer patients.

In biology, imaging has become so central to today's biomedical discoveries that more than 70% of all high-impact biosciences publications rely on advanced light and electron microscopy. We wish to see how things look. By seeing how they look, function can be extracted and comparison of how healthy cells and tissues look in comparison to their pathological state provides extraordinary insight into the molecular nature of disease. Imaging technologies are thus the central technology platform that drives fundamental research in most disciplines within the biological and medical sciences.

What is Euro-BioImaging?

Euro-BioImaging (www.eurobioimaging.eu) is a large-scale pan-European research infrastructure project on the ESFRI Roadmap[1]. 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 services and training for infrastructure users and providers. The research infrastructure will consist of a set of complementary, strongly interlinked and geographically distributed Nodes that provide physical access to European scientists in all Member States. The pan-European infrastructure will be empowered by a strong supporting and coordinating Hub. The Hub will provide the single entry point for the user who will be guided to the requested imaging technology as served by the Euro-BioImaging Nodes. At the Hub, user access, data services and training activities tailored to the needs of users of the imaging infrastructure will be coordinated. The Euro-BioImaging Hub will ensure coordinated and complementary infrastructure deployment, so that investments in imaging infrastructure will be used in the most cost-effective way and served to the users with the highest quality standards in management of open access imaging facilities.

Who is behind Euro-BioImaging?

Broad European support. Euro-BioImaging has a strong and growing supporter base. The consortium comprises 38 beneficiaries from 15 European Member States and 1 international organization, 250 associated partners from 26 European Member States and associated countries. Euro-BioImaging is formally endorsed by over 200 universities, research councils, funding bodies and ministries. The unique opportunity for boosting the European economy has been formally endorsed by the Euro-BioImaging Industry Board, which comprises more than 50 vendors and producers of biological and medical imaging instrumentation. In total, there are over 2,500 stakeholders coming from more than 30 European Countries, India, Russia, the USA and Australia. A smooth transition from the preparation to implementation phase is ensured through the Euro-BioImaging Intergovernmental Working Group (IWG), which prepares for the Interim Phase and forms the Interim Euro-BioImaging

[1] ESFRI, the European Strategy Forum on Research Infrastructures, is a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach. The competitive and open access to high quality Research Infrastructures supports and benchmarks the quality of the activities of European scientists, and attracts the best researchers from around the world. *(Source: ESFRI website of the European Commission http://ec.europa.eu/research/infrastructures/)*

Board. This group currently comprises national representatives from 21 countries, who are mandated by their ministries and/or national funding bodies, and from EMBL.

Shaping national into European communities. The Euro-BioImaging infrastructure project is the driving force to organize the European BioImaging infrastructure communities. To date, 23 national initiatives have been formed to prepare and support their national imaging facilities for participation in Euro-BioImaging, each community represented by a national coordinating person. It is expected that more national communities will organize themselves in the future. Together, they will form a pan-European community of imaging infrastructure providers from the national communities that supports the Euro-BioImaging principles of coordination and harmonized infrastructure deployment, open access and highest training standards.

Why Euro-BioImaging?

- ✓ *Impact.* By investing in a common European research infrastructure for imaging, Europe will secure its global leadership position in imaging technologies by fundamentally improving the ability of its approximately 500 000 life scientists to conduct world-class research. This will increase Europe's competitiveness, open new research fields to European research and fundamentally advance the molecular understanding of health and disease. New and faster drug development will be enabled, leading to better diagnosis, therapy and disease prevention. Euro-BioImaging will provide the essential imaging infrastructure for European scientists to develop the innovative solutions for the grand societal challenges including health, food security, bio-economy, inclusive and innovative societies. It will increase Europe's knowledge-based industry and foster the development and utilization of intellectual property.

In 2012, Euro-BioImaging carried out a test-operational phase to demonstrate that a distributed imaging infrastructure offering open access can operate successfully and boost European life science research. In only four weeks, 228 researchers from 25 European countries and abroad (including USA, India, Australia, Singapore) submitted project proposals and 110 user projects were prioritized and conducted at 41 imaging facilities located in 14 European countries. 21 projects have already led to publications in peer-reviewed journals, another 21 manuscripts are under review or prepared for submission. Based on the overwhelmingly positive feedback from this test-run and the 2200 future user projects submitted as part of the 1st call for Nodes in 2013, Euro-BioImaging foresees 1.500 - 2000 user access requests for its first year of operation.

- ✓ *Better return on investment for biological and medical imaging platforms.* A typical medical MRI instrument may be of the order of €2 million. A large cutting edge research ultra-high field MRI may cost upwards of €30 million. The latest super resolution light microscopes and state-of-the-art electron microscopes cost of the order of €2-5 million each. While a single university department may afford one or two of these instruments, no single European country can run a world-leading imaging infrastructure covering all technologies needed by European researchers to remain at the forefront of their respective research field. It is therefore critical that a plan is developed for sharing the costs of deployment and providing

open access to such expensive but critically important technologies in order to obtain a better return on investment. This is all the more important in times of financial austerity. By realizing the benefits of a coordinated deployment, Euro-BioImaging will decrease expenditures and optimize cost-effectiveness. Rather than having to fund only individual requests for new imaging instruments, funding agencies will have the opportunity to supply the much lower partial costs of accessing shared Euro-BioImaging infrastructure to ensure access to the latest state-of-the-art imaging technologies.

- ✓ *A sustainable investment into the future*. Overtime, Euro-BioImaging will result in more cost effective investment into imaging infrastructure. **It should not be seen as an increase in total investment** into imaging infrastructure but rather that at any time, whatever funds are available to be invested into imaging infrastructure will be much more cost effectively implemented if guided towards open access imaging infrastructure that bear the Euro-BioImaging "Quality Seal". The longer term sustainability of the Euro-BioImaging infrastructure is achieved through the realization of access fees collected from the base of users. Euro-BioImaging, through its Proof-of-Concept Studies and also through analysis of currently running and successfully self-supporting European imaging facilities, has proven the feasibility of this expectation and has mapped out the roadmap of how to get there.

- ✓ *Brain gain instead of brain drain.* The best young scientists quickly move to the best international environment for their research. Euro-BioImaging will make sure that Europe continues to offer cutting-edge infrastructure in biological and medical imaging to the next generation of scientific leaders and allow Europe to attract the best talent from other countries rather than losing its own. For example, Euro-BioImaging has received more than 2,200 research project proposals that are well-defined and committed to be performed, and which have been submitted by applicants in the First Open Call for Euro-BioImaging Nodes (January to April 2013). Additionally, construction of new or upgrades of existing imaging facilities in different European regions will create new job opportunities for high potentials benefitting the European economy by attracting the best professionals to the world-class research and technology environment created by Euro-BioImaging.

- ✓ *Instant Access.* The time required to establish advanced and powerful imaging platforms is substantial. For example, building an ultra-high-field MRI suite can take years for the largest research magnets. Configuring, ordering, installing and putting into routine data production takes on the order of 6-12 months for the latest research level laser scanning microscope and setting up a high throughput microscopy pipeline can take years. Euro-BioImaging will allow researchers instant access to imaging instrumentation not available at their home institution.

- ✓ *Service and training by the leading experts in the field.* Top-level expertise for many imaging techniques is hard to find and takes years of training to acquire. Euro-BioImaging will have coordinated training programs for its infrastructure providers to ensure that the imaging technologies are supported and reinforced by world-leading expertise. Sharing expertise extends to shared best practices across Euro-BioImaging facilities, as well as repositories of methods, tools, protocols, software applications and image data that will make expertise widely available to the research community.

- ✓ *Better image data storage, sharing and analysis.* Image data is recorded across different biological scales, from sub-cellular structures to organs and in different biological models, from single cultured mammalian cells, via mouse to human tissues. The maturity of the ways image data is stored and used varies greatly amongst the research communities. The Euro-BioImaging infrastructure will offer platforms for storing, remotely accessing, sharing and post-processing biological and medical imaging data on a large scale. The definition of standards on data storage, protection and analysis of images by Euro-BioImaging will enable scientists to share image data between different scientific communities from different countries and to reuse existing data in light of new scientific questions.

- ✓ *Defragmentation, integration, and collaboration.* Different geographical areas of Europe have vastly different qualities of research infrastructure. Europe will under exploit much of its potential if a large percentage of its research community do not have access to state-of-the-art technologies and are therefore not competitive. Euro-BioImaging will address this challenge and enable scientists coming from regions of less developed research infrastructure, to access cutting edge imaging technologies, expertise and training either by going to neighbouring regions or by setting up new infrastructure according to Euro-BioImaging standards regionally. The harmonization of access to imaging technologies as well as the training and exchange of best-practices among imaging facility staff across Europe will overcome the current fragmentation of the European research landscape in this area. At the same time, Euro-BioImaging will massively increase the international visibility of local and regional academic research institutions by common research, training and scientific conference activities.

- ✓ *A platform for translational research.* The scientific communities of basic biological, molecular and medical imaging work closely together in Euro-BioImaging to integrate imaging technologies employed in basic research with those applied in medical research. Such cooperative facilities will be ideal platforms for translational research and bring innovative new imaging technologies from bench to bedside.

When will Euro-BioImaging be launched and its benefits realized?

- ✓ *Preparatory Phase:* 2010-2013. The Preparatory Phase of Euro-BioImaging started in Dec 2010 and finishes in November 2013, with a smooth transition into the Interim Phase as prepared by the Consortium and the Intergovernmental Working Group (IWG). By this date, the Euro-BioImaging Consortium will deliver a clear and precise description of the Euro-BioImaging infrastructure model to the European Commission and the IWG. The final decision regarding the legal framework and finance plan will be made by the Euro-BioImaging Member States as represented in the Interim Euro-BioImaging Board during the Interim Phase.

- ✓ *Construction Phase:* ongoing - 2016. The Euro-BioImaging infrastructure is deployed by either newly constructed or major upgrades of existing facilities funded mainly by Member States. The construction phase of Euro-BioImaging is already ongoing at the national level. Euro-BioImaging upgrades have or are already being implemented with committed financial

contributions in 13 Member States (202 million Euro have been invested to date). As countries are not synchronous in their national infrastructure funding cycles, the construction phase can be expected to continue thru 2016.

To make a realistic scenario for its start-up phase, Euro-BioImaging conducted its 1st Open Call for Expressions of Interest for Nodes (Feb - June 2013). This allowed a sound estimate of the real investments needed for its first generation of Euro-BioImaging Nodes in its Member States and the number of users they would serve. The call provided data on 71 potential Euro-BioImaging Nodes including the investment needed for upgrades and new construction, as well as for expert technical staff and operational cost for the first five years of Euro-BioImaging. The Independent Evaluation Board highly recommended 25 Node applications for implementation.

- ✓ *Operation Phase:* 2014 - onwards. Due to the fact that many Euro-BioImaging facilities are already operational, it is planned to start Euro-BioImaging operation as soon as possible. It is planned to begin the start-up operation about one year after the end of the preparatory phase (between December 2014 to June 2015).

How will the goals of Euro-BioImaging be achieved?

Euro-BioImaging Eligibility Criteria. An important element of the implementation plan for the Euro-BioImaging infrastructure are the eligibility criteria for imaging facilities that wish to become part of Euro-BioImaging. The overarching principles for these criteria are technical and scientific excellence, open access to imaging technology, and provision of the highest quality service staff and user training. During the Euro-BioImaging Proof-of-Concept Studies these criteria and guidelines were tested for best practice and used as evaluation guidelines in the 1st Open Call for Nodes by the Independent Evaluation Board.

Euro-BioImaging "Quality Seal". Euro-BioImaging will award imaging facilities that meet the highest quality standards with the Euro-BioImaging "Quality Seal". This attestation stands for five key service components, which the imaging facility should provide:

- Open and transparent based on scientific merit of the user proposal
- Provision of state-of-the-art imaging equipment
- Availability of leading technical expertise
- Quality management in place
- Professional operational and management model in place

In order to achieve and maintain this certification, Euro-BioImaging Nodes will be regularly evaluated according to defined quality criteria (see above). Obtaining the Euro-BioImaging "Quality Seal" has a strong influence on funding decisions by national authorities and funding agencies on Node implementation as seen in the outcome of the 1st Open Call. Facilities that do not meet the quality requirements at the moment of evaluation will be guided through the process of service improvements.

Operational Models. Euro-BioImaging will develop a European legal framework that respects the requirements of the legal and administrative environments of the different Member States. Existing

funding mechanisms and measures on various levels (local, regional, national etc.) are taken into consideration to implement Euro-BioImaging Nodes and Hub.

How can you support Euro-BioImaging?

Become involved now. The Euro-BioImaging Consortium invites the research ministries, research councils, and all national as well as regional funding agencies from the ESFRI Member States to actively participate in Euro-BioImaging. Currently, 22 countries are represented in the Intergovernmental Working Group and in order to finalize the Euro-BioImaging Memorandum of Understanding for the countries' signatures by the end of the Preparatory Phase. The signatories will form the Euro-BioImaging Interim Board, which will be in the driving seat during the Interim Phase. The Interim Board will define and decide with regard to the final Euro-BioImaging governance structure, finance plan, users' access policy etc. based on the recommendations made by the Preparatory Phase Consortium. The Board remains open for new countries and international organizations to join at anytime.

At the same time, Euro-BioImaging is actively engaging with policy makers at the European level to advocate sustainable investment into Europe's future imaging infrastructure.

If you plan to send a representative from your country to join the IWG, please contact one of our project managers (contact details see below).

Funding models tailored for you. In many European countries a large fraction of national investments, i.e. 202 million Euros have already been made into potential future Nodes of Euro-BioImaging, that have formally expressed their interest to contribute their capacity to the pan-European infrastructure. Another 142 Million Euros has additionally been applied for by such potential future Nodes in the framework of national infrastructure funding instruments. Because of Euro-BioImaging, these funding commitments are now coupled to open user access in many countries, which adds significant value to the investment by impacting many more scientists than comparable investments in the past. In addition, coordinating the procurements for the whole country by the national BioImaging chapters has led to large cost savings.
The Euro-BioImaging infrastructure model is scalable and will grow over time depending on the number of users it serves. In addition, the modular nature of Euro-BioImaging as a distributed infrastructure with complementary imaging technologies, allows attractive investment models tailored to the national needs and capabilities.

Submit a Letter of Intent to become an Associated Partner of Euro-BioImaging.

If your institution wants to express its interest in the Euro-BioImaging project we invite you to submit a Letter of Intent at any time. Please find respective templates at www.eurobioimaging.eu.

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