

Euro-BioImaging

European Biomedical Imaging Infrastructure - from Molecule to Patient

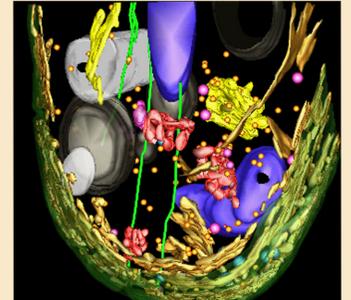
BACKGROUND

Research in, and application of, biomolecular and biomedical imaging is progressing rapidly and increasingly this growth is in a multidisciplinary manner. Innovative imaging techniques are key tools for all life scientists to understand living systems at both the molecular and the physiological level, from biological model systems to patients. Imaging technologies are core disciplines of tomorrow's biology and medicine, and represent essential new research infrastructure for the life sciences. Euro-BioImaging brings together two key research areas in the imaging field at both a basic biological imaging level, with advanced light microscopy, and at the clinical level with medical imaging.

Functional imaging of live cells. This node will provide access to methods that visualize molecular function in live cells. Key technologies will include fluorescence lifetime imaging (FLIM), fluorescence (cross) correlation spectroscopy (FCCS), photoactivation and photobleaching (PA, FRAP), single molecule imaging, and novel fluorescent reporters of biochemical reactions.

Correlative light and electron microscopy. In this node it will be possible to combine dynamic functional assays in live cells directly with high resolution 3D morphology at molecular resolution by EM (cryo) tomography. This node will be intimately linked to EM activities in the ESFRI initiative INSTRUCT.

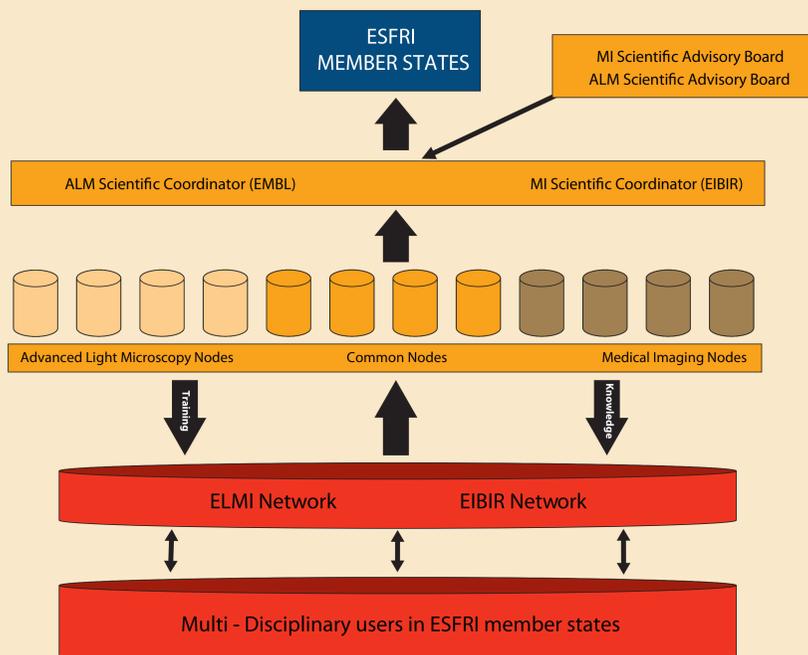
High throughput microscopy for systems biology. This node will contribute to systems biology and rational drug development by providing access to automation and high throughput in advanced light microscopy methods including ultra high content screening of genome level systematic perturbations of biological systems such as RNA interference over-expression or small molecule screening.



THE FACILITY

Euro-BioImaging will provide access to imaging technologies across the full scale of biological and medical applications, from molecule to patient. It will be organized as a pan-European distributed Research Infrastructure (RI). The RI will be newly constructed or undergo major upgrades in order to devote a significant part of its capacity to external users and is focused on complementary imaging technologies from advanced light microscopy to medical imaging.

Euro-BioImaging infrastructures will meet the challenge for access to state of the art equipment as well as provide training and continue the development of imaging technologies. As imaging methods are grouped around different scales of biological organization, from the molecule to the human organism, Euro-BioImaging nodes will be complementary, rather than redundant, to allow focused use of resources in dedicated centres of excellence. The over-arching Euro-BioImaging goal is to provide research infrastructures for multidisciplinary projects by combining biologists, chemists, physicists, bioengineers, computer scientists, imaging technologists and clinicians in order to deliver world class methods for biological and medical applications. The nodes listed below are the core that will set a pan-European foundation for Euro-BioImaging.

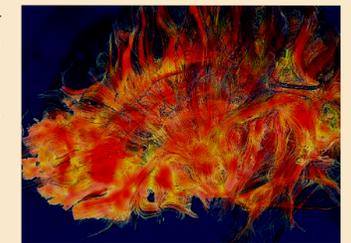


Medical imaging nodes

Euro-BioImaging will provide an infrastructure in medical imaging through dedicated biomedical imaging nodes focusing on the following key areas:

Design and testing of novel agents and probes. This node will provide access to new imaging agents that can improve visualization of pathologies and cellular processes. Nanotechnology is an important aspect of this node that will allow users to apply quantum dots, nanoparticles, nanoshells, microbubbles, radiolabelled contrast materials, and smart imaging agents that are multifunctional or activatable.

Population based imaging: Structural and functional changes occur in the years preceding clinical onset of disease. This node will support imaging in large, prospective epidemiological studies in unselected populations. This enables identification of imaging biomarkers and risk factors of pre-symptomatic disease.



Clinical trials in imaging. New methods in medical imaging are often adopted without sufficient scientific proof and larger clinical trials with appropriate endpoints to prove the benefits should be planned. This Euro-BioImaging node will create the infrastructure for planning, conducting and monitoring large clinical multi-centre trials in diagnostic imaging and image-guided interventions.

Minimally invasive image-guided interventions. Will give access and disseminate optimized tools for application in minimally invasive image-guided interventions. Providing detailed 3D and 4D information on the anatomy and function acquired prior to the intervention will improve navigation and reduce intraoperative radiation and intervention time. Image guidance will also be applied to stem cell therapy on many levels.

Common nodes

All imaging approaches whether they use advanced light microscopy or medical imaging techniques have common needs in data processing and organization and meet in imaging of animal models. EuroBioimaging will address these needs in common nodes.

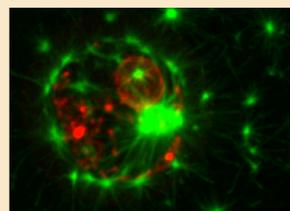
Large scale image processing and computing. Will provide access to quantitative image processing methods and develop concepts for computing infrastructure for large scale image data volumes generated by present and future biomedical imaging technologies.

Databases for quantitative biomedical imaging. Will provide access to database models for quantitative imaging data. For large scale quantitative datasets, central digital repositories will be developed that are essential for imaging phenotypes of multiple diseases as well as personalized therapeutic approaches. This node will be intimately linked and synergistic with the ESFRI initiative ELIXIR and other databases.

Imaging of tissues and animal models: Will provide access to methods for imaging tissue function from animal brains to whole animal models. Key technologies will include multiphoton live imaging, applying light microscopy techniques to animal imaging, ultra-high-field animal MRI and hybrid molecular imaging technologies including PET and SPECT combined with CT or MRI. In addition, new approaches in intravital imaging such as novel miniaturized objectives and microchip lasers will be explored.

Advanced light microscopy nodes

Advanced light microscopy is instrumental to reach the ultimate goal of biological imaging, to visualize single biomolecules and their functions and interactions within the context of live biological systems. The specific nodes will provide the following key technologies.



Superresolution light microscopy. This node will provide access to methods that improve the spatial (and also temporal) resolution of light microscopy imaging with an emphasis on technologies applicable for biological applications and in live specimens. Key technologies will include stimulated emission depletion (STED), photoactivation localization microscopy (PALM) as well as the use of structured illumination.

WHAT'S NEW? IMPACT FORESEEN?

Euro-BioImaging will address the imaging requirements of both basic and medical imaging communities by creating a coordinated and harmonised plan for imaging infrastructure deployment in Europe and thus address the fragmentation of such efforts currently present in Europe. Euro-BioImaging will develop and provide access to new imaging technologies in key areas of biomedical imaging.

In the long term, Euro-BioImaging will provide the technology to visualize the macromolecules of life in their natural environment to enable basic research, diagnosis, therapy and drug design.

TIMELINE AND ESTIMATED COSTS

Preparatory Phase: 2009-2010 (10 M€)

Construction Phase: 2010-2014 (370 M€)

Operation: 2012 onwards (160 M€ per year)

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