
# Euro-BioImaging

European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences

WP9
Medical Imaging – Emerging Technologies

Task 9.5:
Develop construction plan (Lead Beneficiaries: OVGU, UKLFR)

## Deliverable 9.7

Comprehensive construction plan for innovative technologies in Medical Imaging infrastructure

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# 1 Report Summary

Euro-BioImaging Work package 9 “Access to Innovative Technologies – Medical Imaging” is aiming to provide a research infrastructure model for open access to novel medical imaging methods in Europe for biological and medical researchers. Important steps towards the achievement of this goal are the identification of emerging imaging technologies, the evaluation of their maturation level, the determination of needs and requirements to provide user access to these technologies, the organization of the respective scientific communities, and the evaluation of the user demand.
The infrastructure established by Euro-BioImaging will consist of a set of geographically distributed but strongly interlinked imaging facilities (Euro-BioImaging Nodes). In 2013, Euro-BioImaging published an open call for Nodes and invited imaging facilities in all ESFRI countries for the first time to express their interest in joining the future Euro-BioImaging infrastructure by becoming a Euro-BioImaging Node.

Due to the high scientific relevance and the high user demand, the following modalities were included in the first open Call for Nodes regarding Medical Imaging:

- Ultra-high Field MRI
- Combined MR-PET
- Phase Contrast X-ray Imaging

A small number of research institutions are currently operating these modalities, continue their technical development, and at the same time have demonstrated their high potential for application in clinical science and basic research in humans.
Further modalities that have been identified during the preparatory phase of Euro-BioImaging were not included in the call as these technologies are at an early stage and will require not only further technology development but also research into possible applications in order to be of general interest to the European researchers. The latter are combined MEG and ultra-low-field MRI (MEG-MRI), magnetic particle imaging (MPI) and electron paramagnetic resonance imaging (EPRI).

# 2 Open Call for Euro-BioImaging Nodes

Euro-BioImaging is a pan-European infrastructure project with a mission to build a distributed imaging infrastructure across Europe that will provide open access to innovative biological and medical imaging technologies for European researchers. The infrastructure established by Euro-BioImaging will consist of a set of geographically distributed but strongly interlinked imaging facilities (Euro-BioImaging Nodes). From January to April 2013, Euro-BioImaging published an open call for Nodes and invited imaging facilities in all ESFRI countries for the first time to express their interest in joining the future Euro-BioImaging infrastructure by becoming Euro BioImaging Nodes.

In relation to Innovative Medical Imaging Technologies in scope, i.e. Ultrahigh-Field MR, Phase Contrast Imaging and MR-PET, the criteria as described in the document “Technology Review Criteria” (Appendix) have been identified to be critical for providing efficient access to the technology. Applications for the Euro-BioImaging Nodes were evaluated based on the general and technology specific review criteria.

In total, 71 imaging facilities from 19 countries submitted Expressions of Interest (EoI) to Euro-BioImaging. Being committed to an open and comparable Node evaluation mechanism, Euro-BioImaging and its External Advisory Board installed an Independent Evaluation Board (IEB) consisting of international leading experts for imaging technologies and infrastructures. The IEB evaluated all EoIs against the set of general and technology specific review criteria defined by the Euro-BioImaging preparatory phase consortium during May and June and submitted a report and recommendations based on the outcome of this review. The report and more detailed information about the 1st Open Call are available on the Euro-BioImaging website.

## *2.1 The Independent Evaluation Board (IEB)*

### 2.1.1 Composition and objective.

The Independent Evaluation Board (IEB) is a voluntary body supporting Euro-BioImaging with the 1st open call for Nodes. It comprises non-European international senior experts in imaging technologies and infrastructure with extensive experience and knowledge of imaging infrastructure, technologies and their service to the users. The IEB`s main task was to independently evaluate all of the submitted Expressions of Interest for Euro-BioImaging Nodes and to make recommendations regarding their inclusion in the future European imaging infrastructure. The list of the IEB members can be found in the Annex of this report.

### 2.1.2 Organization

The members of the IEB were appointed by the Euro-BioImaging preparatory phase External Advisory Board, from candidates nominated by the Euro-BioImaging Steering Committee and the coordinating contacts for the 23 National Imaging Communities participating in Euro-BioImaging. To guarantee the independence of the IEB all members are international non-European experts. Advice on the European research infrastructure landscape was provided to the IEB by Eero Vuorio, director of BioCenter Finland, who was present during the final meeting of the IEB as an observer. The IEB is organized into technology specific panels, which were managed by their panel chair. Each panel had at least three members. The IEB as a whole elected Scott Fraser as the IEB Chair and Ian Smith as a Vice chair. The IEB Chair and Vice Chair nominated panel members and chairs, chaired the meeting of the IEB and facilitated the final decision making by the whole IEB, ensuring at the same time that the evaluations by different panels are based on comparable interpretation of the review criteria and were harmonized.

## *2.2 Evaluation Procedure*

Following the deadline for submission of the Expressions of Interest on the 30th April 2013, the Euro-BioImaging project management team validated all submitted EoI forms for formal completeness and eligibility (see the General Criteria for Euro-BioImaging Nodes document listing eligibility criteria). EoIs with minor sections missing were invited to update their EoI and resubmit with minor corrections. In the name of the IEB Chair, all eligible EoIs were forwarded to the technology specific panels. The Euro-BioImaging project management team supported the IEB Chair with all administrative tasks.

### 2.2.1 Principle of evaluation

Evaluation by the panels and the IEB was carried out between May 10th and June 16th 2013, based on the general and technology specific review criteria (see General Criteria for Euro BioImaging Nodes and Technology Specific Review Criteria for Advanced light Microscopy / Molecular Imaging/ Medical Imaging published online).

I) The General Review Criteria cover following topics:

- Scientific and technical excellence of the infrastructure Node
- Quality and scientific field of the academic environment
- Geographic coverage
- Maintenance and update
- European and national significance
- Access and service package
- Use and quality assurance
- User training
- If applicable, evidence of funding commitment by national funders

II) The Technology Specific Review Criteria cover topics as specified in Technology Specific Review Criteria documents. In summary the Technology Specific Criteria and Resources are as follows:

- At the time of the expression of interest to become a Euro-BioImaging Node, resources described in the Technology Specific Review Criteria can be already provided by the institution or consortium, or are planned to be established as part of Euro-BioImaging Node construction.
- In addition to the individual resources listed, future Nodes are expected to have capacities available to handle the often complex administrative matters associated
- A node should provide an infrastructure together with specially trained and experienced staff who will support the user at all levels of the projects
- Technology providers can express their interest to become a “Multi-Modal Technology Node” or “Single Technology Flagship” Euro-BioImaging Node.

The EoIs were evaluated in three steps:

- by panels members individually
- by each panel together (during conference calls, organized by each panel chair)
- by the whole IEB (during physical meeting in Newark, NJ, USA)

Each Expression of Interest was evaluated by at least 3 members of the panel. The final decision on the ranking of all submitted EoIs and harmonization of the EoI evaluations across technology domains and between the different organizational frameworks used by different European countries was then performed by the whole IEB, facilitated by its Chair, during a meeting in New York.

### 2.2.2 IEB Meeting

On June 15th & 16th 2013, a physical meeting of all IEB members took place in New Jersey, at Newark Airport. This was a two day event, during which the IEB discussed individual EoIs and agreed on the results. All panel chairs were present at the meeting, as well as most of the panel members (25 out of 33 IEB members). In addition, Eero Vourio from BioCenter Finland was present as an observer and European Research Infrastructure expert who advised the IEB on European questions. The Scientific Coordinators of Euro-BioImaging, Jan Ellenberg (EMBL) and Oliver Speck (University of Magdeburg) were also present as observers.

# 3 Result of 1st Open Call for Euro-BioImaging Nodes

## *3.1 General Feedback from the Independent Evaluation Board on Euro-BioImaging*

The Independent Evaluation Board highly commended the concept of Euro-BioImaging as a truly pan-European infrastructure network for imaging technologies and stated that it will provide an excellent resource and benefit to the European research community for many years to come. The IEB in particular welcomed the infrastructure model centred on open access to imaging core facilities that will support European users with an easily accessible and integrated service package, along with appropriate training and data handling capabilities.

The IEB acknowledged the overall high quality of submitted Expressions of Interest (EoI), the well-coordinated process of (EoI) submission as well as the transparent provision of clear general and technology specific review criteria. In the opinion of the IEB, the Open Call process provides Euro-BioImaging with an excellent basis to incorporate the best technologies and technical services into the future distributed infrastructure, which in turn will provide open access to these capabilities to European and hopefully also international scientists.

The IEB acknowledged that the review process was conducted in a transparent and harmonized manner allowing for comparable ratings across all technologies that participated in the first open call. In particular the summarizing presentations of the different technology panels and the comparative discussion of the strengths and weaknesses of each EoI served to standardize recommendations across technologies. In addition the IEB carefully considered both the national and European perspectives across technologies (moderated by the IEB national panel) to provide a national summary view and identify particular strengths and synergies between countries that the IEB hopes will provide useful information for the Euro-BioImaging Member States.

**National and European aspects formulated by the IEB for the consideration of the Euro-BioImaging Member States:**

*For countries, in which the infrastructure is technologically very mature and/or is already nationally coordinated and/or funded (examples: France, Germany, The Netherlands, United Kingdom)* the Euro-BioImaging upgrades and open access policy will bring significant added value for national and international researchers as well as for the national imaging facilities. The leading imaging expertise in these countries mandates them to offer this to European scientists with the best research proposals and to support other countries in their efforts to improve their imaging expertise and infrastructure. These countries are therefore highly encouraged to actively participate in Euro-BioImaging and provide their expertise and service. Although in some of these countries national imaging infrastructure networks are in place, establishing national coordinating entities that would create a second layer of access administration for Euro-BioImaging users in addition to the Euro-BioImaging Hub was deemed as an unnecessary duplication of efforts by the IEB and might endanger to provide user access as rapidly and directly as possible.

*Imaging infrastructures in new Member States (examples: Bulgaria, Czech Republic, Hungary and Slovakia):*

Although sometimes not offering the full range of imaging technologies or a comparable level of scientific track record when compared to old member states, the applying imaging facilities were often found to have great potential to reach highest excellence and/or to be important for the European region.

## *3.2 Outcome: Expressions of Interest for Medical Imaging Nodes*

The first Euro-BioImaging Call for Nodes received in total 71 Expressions of Interest (EoI) for Euro-BioImaging Nodes, submitted by 221 research institutions located in 19 European countries.
As outcome of the first call for Node applications in 2013 with respect to Medical Imaging 7 Single Technology Flagship Nodes would offer an innovative technology at European leading level, i.e.

- Ultrahigh-Field MR
- Phase Contrast Imaging
- MR-PET

If a node-applicant wanted to offer more than one innovative technology as flagship capabilities, he might have submitted a single EoI, which contains detailed documentation for each technology to allow evaluation of each technology by the suitable expert groups of the Independent Evaluation Board.

Multi-Modal Technology Nodes would provide excellence by the integration of multiple imaging technologies at one site. A Multi-modal node can include one of the Flagship technologies, in which case the applicant has two options to apply: a) flagship technology is included under the multi-modal umbrella (flagship technology service is not at European leading level) or b) the applicant submits a separate application for the Flagship node for this technology (flagship technology service is at European leading level). Multi-modal technology nodes can include all Euro-BioImaging technologies including biological, molecular or medical imaging.

For operating a multi-modal Molecular Imaging Euro-BioImaging Node, 11 EoIs were submitted by interested research institutions, some of which also include medical imaging modalities (as reported by WP8).

From the 7 Medical Imaging Flagship Technology EoIs the IEB evaluated all 7 EoIs as being suitable for implementation (3 highly recommended, 1 recommended, 1 recommended with minor improvements, 2 recommended with major improvements).

**Medical Imaging Nodes**

The Medical Imaging Node EoIs and their evaluation results are listed below. Details of the applications and the evaluation are made available to the applicants and the members of the IWG. For all three technologies included in the 1st Open Call, leading European research institutions (single-site) or consortia of complementary technology and expertise (multi-site) have submitted EoIs. In all three technology fields one application was rated as “highly recommended” and further applications were “recommended” or considered for future integration after improvements. It can therefore be concluded that world-leading expertize and technology is available in the European member states to construct the required Euro-BioImaging infrastructure for Innovative Technologies in Medical Imaging.

Single Technology Flagship EoIs in UHF-MR:

- HFMRI (multi-site), DE: *Highly Recommended Expression of Interest for Euro-BioImaging Node*
- HFMRI (multi-site), NL: *Expression of Interest requires minor improvements*
- HFMRI (single-site), ES: *Expression of Interest requires major improvements*

Single Technology Flagship EoIs in MRI-PET:

- MRIPET (multi-site), DE: *Highly Recommended Expression of Interest for Euro-BioImaging Node*
- MRIPET (single-site), SE: *Expression of Interest requires major improvements*

Single Technology Flagship EoIs in PCI:

- PCI (single-site), IT: *Highly Recommended Expression of Interest for Euro-BioImaging Node*
- PCI (single-site), DE: *Recommended Expression of Interest for Euro-BioImaging Node*

# 4 Next Steps

This section provides a summary of the information distributed to all EoI applicants about the next steps in the construction of Euro-BioImaging Nodes and some general recommendations to applicants on possible actions they may consider following the evaluation by the Independent Evaluation Board.

## *4.1 Establishing a Euro-BioImaging Node*

Establishing a Euro-BioImaging Node is a three step process

1) **Submission of an Expression of Interest (EoI) by imaging facilities interested in establishing a Euro-BioImaging Node**. For the 1st Open Call, submitted EoIs have now been evaluated by the Independent Evaluation Board and the results communicated to the imaging facilities. Following this communication the EoIs were forwarded to the Intergovernmental Working Group (composed of national ministry and funding authority representatives) for their information and to support the Node selection and implementation process.

2) **Decision by national funders to invest in and build the Nodes.** The Member States and national funders now decide on funding Node construction in each country. They may use the Euro-BioImaging Open Call evaluation results as a recommendation for their decision-making. *However, there is no mandatory cut-off imposed by the evaluation results and the final decision on which Nodes to establish will remain at the discretion of the Member States.* This means that the funders can decide to fund Nodes which received a comparatively lower ranking if they see the possibility to make improvements and wish to realize the added value they would bring. Overall this second step will result in the construction or upgrade and opening of the national Nodes in many countries.

3) **Decision by the future Euro-BioImaging Board on which of the funded Nodes to include in the pan-European infrastructure.** Nodes can already function and provide user access at the national level before this decision is made. From the pool of funded national Nodes, the Member State representatives on the Euro-BioImaging Board will decide which Nodes to include in the Euro-BioImaging infrastructure. To start this common European level decision making process, the Euro-BioImaging project management team has communicated the results of the independent evaluation to the Euro-BioImaging Intergovernmental Working Group (IWG), which is a forerunner of the Euro-BioImaging Interim Board and currently consists of representatives of national funding bodies and ministries from 21 European countries as well as EMBL that are engaged with Euro-BioImaging. The IWG is now preparing the Euro-BioImaging MoU for signature by their countries. Following this process, the Interim Board will comprise all signatories of the Euro-BioImaging MoU and it will take all major decisions in the transition phase. The Interim Board will discuss the results of the 1st Open Call for Nodes and start to assess the balance between imaging technologies and regional distribution of Nodes that would be desirable from the funders' point of view. At the end of the transition phase, the IWG will hand over decision-making power to the Euro-BioImaging Board. The Interim Board will likely make recommendations to the Euro-BioImaging Board on which Nodes to include in the starting phase of the Euro-BioImaging infrastructure, but the final decision will be made by the Board itself.
The Euro-BioImaging Board will be the decision-making body of the future European Research Infrastructure comprising the representatives from all Euro-BioImaging Member States.

# 5 Annex

## *5.1 Independent Evaluation Board Members*

Euro BioImaging is honored to have the following distinguished imaging experts as members of the IEB.
1. Scott Fraser (IEB Chair), California Institute of Technology
2. Ian Smith (IEB Vice Chair), Monash University
3. Rob Singer, Albert Einstein College of Medicine
4. Hedvig Hricak, Memorial Sloan Kettering Cancer Center
5. Sanford Simon, The Rockefeller University
6. Satyajit Mayor, National Center for Biological Sciences, NCBS
7. Holly Aaron, University of California, Berkeley
8. Alison North, The Rockefeller University
9. Katharina Gaus, The University of New South Wales
10. Teng Leong Chew, Northwestern University
11. Diane Lidke, University of New Mexico
12. Mary Dickinson, Baylor College of Medicine
13. Jennifer Waters, Harvard Medical School
14. Harald Hess, Howard Hughes Medical Institute
15. Doug Murphy, Howard Hughes Medical Institute
16. Paul Wiseman, McGill University
17. Jennifer Lippincott Schwartz, National Institutes of Health
18. Bob Goldman, Northwestern University
19. Simon Ringer, University of Sydney
20. Shimon Weiss, University of California, Los Angeles
21. Allan Johnsson, Duke University
22. Sam Gambhir, Stanford
23. Mike Modo, University of Pittsburgh
24. Mark Pagel, University of Arizona
25. Norbert Pelc, Stanford School of Medicine
26. Enrico Gratton, University of California, Irvine
27. Kevin Eliceiri, University of Wisconsin
28. Graham Galloway, University of Queensland
29. Mark Henkelman, University of Toronto
30. Kamil Ugurbil, University of Minnesota
31. Carl Kesselman, University of Southern California
32. Jeffrey Duerk, Case Western Reserve University
33. Carl Fredrik Westin, Harvard Medical

## *5.2 Technology Review Criteria for Medical Imaging Technologies*

# MEDICAL IMAGING

## TECHNOLOGY SPECIFIC REVIEW CRITERIA FOR EURO-BIOIMAGING NODES

January 31st, 2013

# TABLE OF CONTENTS

# Introduction

Based on the PCS studies conducted in Euro-Bioimaging in relation to Innovative Medical Imaging Technologies, i.e. Ultrahigh-Field MR, Phase Contrast Imaging and MR-PET, the following criteria, in addition to the general eligibility criteria, have been identified to be critical for providing efficient access to the technology. Applications for the Euro-BioImaging Nodes will be evaluated based on the general and technology specific review criteria.

Technology Specific Criteria and Resources:

Technology specific review criteria refer to the resources that are either required or desirable to enable user access to medical imaging technologies in Euro-BioImaging Nodes**.**
**At the time of the expression of interest to become a Euro-BioImaging Node, resources described here can be already provided by the institution or consortium, or are planned to be established as part of Euro-BioImaging Node construction. In order to assist evaluation of the expression of interest, each Node applicant is invited to provide as many of the mentioned resources as possible. However, EoIs of technology providers who plan to only offer a selection of these resources will also be considered.**

**In addition to the individual resources listed here,** future Nodes are expected to have capacities available to handle the often complex administrative matters associated, in particular, with radiotracers, animal facilities, and model organisms where required.
In the framework of Euro-BioImaging, it is expected to have considerable diversity between medical imaging users, depending on their expertise and availability of certain technology at their home institution. In order to successfully host all users, a node should provide an infrastructure together with **specially trained and experienced staff** who will support the user in project planning, protocol optimization, patient or subject recruitment, data acquisition & storage, data processing, analysis & interpretation and who will enable users to utilize the facility in the best possible way. This mandatory comprehensive support will also ensure that data is recorded under optimal technical conditions.

Types of Nodes:

Technology provider can express their interest to become a “Multi-Modal Technology Node” or “Single Technology Flagship” Euro-BioImaging Node.
**Single Technology Flagship Nodes** would offer an innovative technology at European leading level. Following innovative medical imaging technologies can be offered by the future flagship Nodes in the first call for Node applications in 2013:

- Ultrahigh-Field MR
- Phase Contrast Imaging
- MR-PET

If a Node-applicant wants to offer more than one innovative technology as flagship capabilities, it may submit a single expression of interest, which contains detailed documentation for each technology to allow evaluation of each technology by the suitable expert groups of the Independent Evaluation Board.
*Multi-Modal Technology Nodes* would provide excellence by the integration of multiple imaging technologies at one site. A Multi-modal node can include one of the Flagship technologies, in which case the applicant has two options to apply: a) flagship technology is included under the multi-modal umbrella (flagship technology service is not at European leading level) or b) the applicant submits a separate application for the Flagship node for this technology (flagship technology service is at European leading level). Multi-modal technology nodes can include all Euro-BioImaging technologies including biological, molecular or medical imaging.

# Technology Review Criteria for Medical Imaging Euro-BioImaging Nodes

## *Ultra High Field- MR*

1. The infrastructure should be able to **support users at all levels of Ultra High Field-MR (UHF-MR)-based projects**. These are: measurement sequences suitable and optimized for the addressed field of application, RF coils and other pertinent hardware, data management and handling, tools for image analysis, processing and evaluation (e.g. for statistical analyses and presentation of results or correction of systematic errors during image acquisition). **Experienced staff to support users** in all these activities will be necessary.

2. High impact UHF-MR projects typically last several months and sometimes even beyond one year. This may require repeated visits of the users to the infrastructure at different stages of the project. At early stages the feasibility of large-scale projects needs to be evaluated and if necessary terminated or postponed. Therefore, it is essential to have in place a **project management and planning procedure and experienced staff able to over-see the project at all stages to support users**.

3. Infrastructures need to be able to support multiple users over extended periods and need **dedicated staff to support projects with different aims**. A node should provide a friendly and expert environment that helps to run the experiment, helps in the interpretation, hosts and trains its users and teaches them to use the facility in the best possible way. **Staff** at the infrastructures **needs to be knowledgeable about pertinent fields of application of UHF-MR** as well as their range of imaging techniques in order to be able to judge commitment expertize and required support level of potential users.

4. With open access, the application of new instruments to new applications may be common and there could be a difficult learning curve for users as well as node staff. Nodes need to be **able to support users over extended periods and to have appropriate staff,** who have the time and resources to learn new skills or knowledge for specific projects. Staff will not be leading the user projects, however, and so must get appropriate recognition and career development in these support roles that will take up much of their time.

## *Phase Contrast Imaging (PCI)*

1. The infrastructure must be able to **support the users in all aspects during** an entire PCI based project, including:

- method selection,
- preparation of sample or experimental animals,
- experimental data collection,
- data processing and image calculation
- mathematical evaluation of the data.

For PCI, data analysis is complex and methods are not yet standardized. Special attention should be paid to this circumstance by allowing extra time and resources for user support in this aspect. Nevertheless, specially trained and experienced staff in the facility should warrant all aspects of support.

2. Since PCI is an innovative technique users may often be inexperienced. Therefore, proper discussion of projects ahead of start maybe necessary. For one project there should often be multiple **visits planned**: A first short visit to make preliminary tests of the applicability of methods and targeted samples or sample animals, followed by more elaborately planned visits for data collection. The latter visits should host the detailed set of measurements to complete the entire set of experimental data needed. The infrastructure should provide a clear project plan for a mandatory and structured preparation phase existing before the first visit of the user. This is to accommodate them with the different assessment and analysis technologies available and to assess which of these methods is the best in order to tackle the given questions. For example, images with reference methods such as CT and MRI should, if applicable, have been recorded upfront to show the limitations of the conventional techniques. This requires sufficiently **trained and experienced staff for project management and project planning**.

3. With open access, the application of new instruments to new applications may be common and there could be a difficult learning curve for users as well as node staff. Nodes need to be **able to support users over extended periods and to have appropriate staff,** who have the time and resources to learn new skills or knowledge for specific projects. Staff will not be leading the user projects, however, and so must get appropriate recognition and career development in these support roles that will take up much of their time.

1. The infrastructure should be able to support users at all levels of an MR-PET-based project. These are: definition and setup of bimodal protocols, selection of the radiotracer appropriate for the specific question to be studied, application for legal approval of studies using radiotracers in human research, selection and optimization of adequate MR sequences, optional equipment for blood sampling, optional equipment for metabolite correction, data management and handling, tools for image analysis, framework for quantitation and kinetic analysis of PET data, processing and evaluation (e.g. for statistical analyses and presentation of results or correction of systematic errors during image acquisition). **Experienced staff to support users in all these activities will be necessary**.

2. With the involvement of PET in MR-PET one has to take into account that the feasibility of an MR-PET project might depend heavily on the availability of PET-radiotracers adequate for the specific question to be studied. Infrastructures can either rely on commercially available tracers or develop and produce tracers. Therefore, only those studies can be realized in an infrastructure in which the demanded radiotracer is already available or can be made available in short time. Furthermore, the time to obtain the legal approval of studies using ionizing radiation and radiotracers in human research may be dependent on the specific national and/or regional situation. The infrastructure should be able to take responsibility for these applications. Thus, the preparation phase of MR-PET projects may last even beyond one year if non-standard radiotracers are required. Repeated visits of the users to the infrastructure at different stages of the project are necessary. At early stages the feasibility of such large-scale projects needs to be evaluated and if necessary terminated or postponed. Therefore, it is essential to have in place a **project management and planning procedure and experienced staff able to over-see the project at all stages to support users**.

3. Infrastructures need to be able to support multiple users over extended periods and need **dedicated staff to support projects with different aims**. A node should provide a friendly and expert environment that helps to run the experiment, assists in the analysis and interpretation, hosts and trains its users and teaches them to use the facility in the best possible way. **Staff** at the infrastructures **needs to be knowledgeable about pertinent fields of application of MR-PET** as well as their range of imaging techniques in order to be able to judge commitment of potential users.

4. With open access, the suggestions for new applications may be common and there could be a difficult learning curve for users as well as node staff. Nodes need to be **able to support users over extended periods and to have appropriate staff,** who have the time and resources to learn new skills or knowledge for specific projects. Staff will not be leading the user projects, however, and so must get appropriate recognition and career development in these support roles that will take up much of their time.

# Overview of Technology Review Criteria for MI Euro-BioImaging Nodes

| Type of Node | | Technology | Facilities | | | | | | | | | Training | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Multi-modal | Flagship | | 1. Probes | 2. Animal Facility | 3. Biobanking | 4. High Biological Safety Level | 5. Workstations - Desk, ICT access | 6. Data Storage - images | 7. Accommodation | 8. Mechanical Shop | 9. Patient / Subject recruitment | 10. Methodological set up | 11. Facility Induction | 12. Technical assistance to run instrument | 13. Image acquisition | 14. Image processing and analysis | 15. Project planning |
| | | | Priority | | | | | | | | | | | | | | |
| | Yes | **Phase Contrast Imaging** | N.A. | High | Med. | Med. | High | High | Med. | Med. | Med. | High | High | High* | High | High | High |
| | | | | | | | | | | | | | | | | | |
| | Yes | **Ultra High Field MRI** | N.A. | Med. | N.A. | N.A. | High | High | Med. | Med. | Med. | High | High | High* | High | High | High |
| | | | | | | | | | | | | | | | | | |
| Yes | Yes | **MR-PET** | High** | N.A. | N.A. | N.A. | High | High | Med. | Med. | Med. | High | High | High* | High | High | High |

*Remark: for medical imaging it is unlikely that the external users will actually run the instrument

**Radiotracers are considered Probes for MR-PET