BioImaging UK June 3rd 2010 meeting

Imperial College London

1. *Welcome and overview including report on Euro-BioImaging - Jason Swedlow*

Jason reported a growing mood of optimism across Europe that new money could be available via the EU for data and research infrastructure projects such as EuroBioImaging. He reviewed the development of the Euro-BioImaging project (**www.eurobioimaging.eu**) to date:

- April 2009: Initial meeting of possible work package leaders for an ESFRI proposal entitled EuroBioImaging. This project was formed out of the union of two previous proposals: "*Advanced Light Microscopy Infrastructures for Europe*" –AMIE (RU 16) concerning imaging at the basic research level and *European Infrastructure for Research in Biomedical Imaging*" –EIRBI (RU 41), which concerned clinical aspects of imaging technologies. Following a strong steer from the Commission, the projects were combined to form a new ESFRI proposal: *Euro-BioImaging* (**European Biomedical Imaging Infrastructure**). The meeting laid out the work packages (WPs) and proposed leads for each WP.

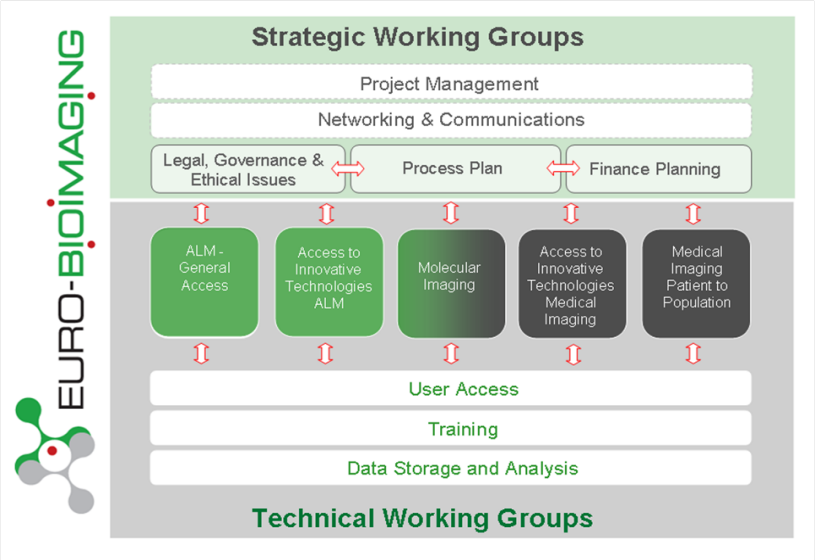
- September 2009: *First Euro-BioImaging Stakeholders' meeting* at EMBL that produced final structure of *Euro-BioImaging* project and WPs:

WP: ALM Infrastructure -General access nodes
WP: Access to Innovative Technologies –ALM
WP: Molecular Imaging
WP: Access to Innovative Technologies –MI
WP: MI -Patient to population

WP: Data management
WP: User Access
WP: Training

WP: Project management
WP: Legal, governance and ethical issues
WP: Process plan
WP: Finance planning
WP: Networking and communications

ALM = Advanced Light Microscopy
MI = Medical Imaging



Euro-BioImaging will run through 3 phases:

2010-2013: Euro-BioImaging Preparatory Phase (funded by the European Commission)
2013-2017: Euro-BioImaging Construction Phase (funded by Member States)
from 2017 : Euro-BioImaging Operation Phase (funded by Member States)

- The proposal for *the preparatory phase* of Euro-BioImaging project was successfully submitted in Dec 2010 and was the highest rated ESFRI proposal. Currently the final contract for ~ €5.2M total funding is being negotiated. The funding has been allocated to the WPs, of which project management is the largest. The deadline for the end of negotiations (based on feedback) and submission of signed papers to EC was 11th June, 2010. The preparatory phase 'proof of concept' work will commence Dec 2010,

Details of the project can be seen at: www.eurobioimaging.eu. This website is currently quite limited and will undergo significant development.

The Euro-BioImaging project is co-ordinated by EMBL and the project managers and points of contact are:

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In terms of formal UK involvement, Jason Swedlow is co-chair of the '*WP: ALM infrastructure - General access nodes'* and Paul French is involved in the '*WP: Access to Innovative Technologies –ALM*' for which he is to pilot access to functional imaging of live cells. BBSRC are contributing to the '*WP: Finance Planning'*.

Jason made the following observations:

- The key message about EuroBioImaging is *coordination* rather than funding. This will not be an opportunity for individual institutions to bid for equipment or research grants but will consider research infrastructure on national scales.
- Accordingly, BioImagingUK has been set up to provide a national forum representing the aspirations and views of the UK bioimaging community. Anyone can join and all are invited to attend our meetings and contribute to the website and wiki at: www.bioimaginguk.org.
- The funding for Euro-BioImaging is expected to come from the member states funding agencies. It is therefore vital to include them in discussions and decisions and the Research Councils/Wellcome Trust have attended/sponsored Bioimaging UK meetings.
- Euro-BioImaging could provide a new channel to engage the UK funding agencies on imaging infrastructure and secure funding for this area.

However,

- There is a sense that existing national money may be supplemented by "new" money from Europe - the European Biological and Medical Sciences Research Infrastructure white paper is the start of this process. This could mean new money coming into the system, tailored to this infrastructure project, not just re-badging of money from existing sources (i.e. national funding bodies)
- EC invited biomedical sciences (ELIXIR, EuroBioImaging etc) and e-infrastructure projects to define data/infrastructure needs and 5 pilot projects were submitted in this area. [Note added: Calls for these projects were announced on 20 July, 2010: http://cordis.europa.eu)

Going forward

- In order to facilitate national discussions about what bioimaging infrastructure is needed, where it might be, how to maximise the impact of existing UK facilities and what new infrastructure should be developed, BioImagingUK needs funding to organise meetings and we should try to obtain this from UK funding bodies. It is important to reach a consensus about bioimaging in the UK and this provides opportunities for strategic development.

- It is important to promote dialogue between the *ALM* and *MI* communities within the UK. To date, there has been much more "buy-in" from the ALM community, particularly imaging facilities' managers, who are already well-networked through, e.g. ELMI and the Royal Microscopy Society. We need to identify corresponding organisations/networks in the medical imaging communities.

- To promote discussion, BioimagingUK is working to produce a strategy document summarising the current state of bioimaging infrastructure in the UK and the community's aspirations and priorities. To this end a number of BioimagingUK work packages have been identified. These are listed on the BioimagingUK website and wiki, to which contributions are welcome. We would like to consolidate the contributions from the working groups and produce the first draft of a strategy document in time for the *2nd Euro-BioImaging stakeholders* meeting, to be held in Vienna over October 21/22, 2010. We would also like to present this to the research sponsors for their comments and input. It would also be useful to disseminate it via the website (and perhaps via a conference) among the UK academic community and industry, to encourage participation. A further tool for this purpose could be a questionnaire. This could also help to generate real data to support the strategy document.

2. *Review of workpackages*

The structure of the work groups was discussed and it was agreed to reorganise them into the structure that is now presented on the BioimagingUK website. It was also agreed that a spokes person or "scribe" needed to be identified for each workpackage with responsibility to draft a summary document. To stimulate interaction with the medical imaging communities, three new medical imaging WPs were created. To reduce overlap and streamline the WPs, the '*Showcase & access for existing commercial methodologies*' WP and '*Access to pre-commercial imaging technology'* WP were merged into the '*National level facilities'* WP. Details of new WPs are at: www.bioimaginguk.org

The following notes were made of the WP discussions that took place at the meeting:

Notes for Software tools and data management WP:

- Standardisation of data formats for archiving, sharing and portability between different analysis tools. It is important that full experiment details (metadata) are stored with image data so there needs to be standard formats for data and metadata BUT with some experiments there are so many experiment parameters that could be described that it would be almost impossible to capture all of it - therefore there is a need to define what is important.
- Research Councils (RC) have mandated that researchers share data but have not specified how to this? For non-specialists this can be challenging and many institutions do not have suitable tools in place for archiving and sharing data. Although RC will fund costs of data sharing, they are unlikely to fund every researcher to establish their own infrastructure – and this would be a waste of money. This needs co-ordination and some (e.g. OMERO) are trying to provide common tools but RCs have to date declined to fund proposals from users aiming to implement OMERO or other scientific image data management software for users
- Should BioImagingUK lobby the RC to make it compulsory for everyone to make data available in the same way, with a centrally stipulated system/format? We need clarification from RC and other sponsors on the data archiving/access/sharing
- One issue is the sheer expense of data storage for 10 years. Do researchers really need to store all their data? If so, institutions and researchers need guidelines;
- Do RC need to differentiate between published and unpublished data?
- With medical imaging data there is the issue of patient anonymity – clear guidelines are needed across UK/EU
- Publishers are requiring data archiving and access so we need some standard mechanism for data repositories (e.g. JCB requires data to be stored on its OMERO-based server, the JCB DataViewer)
- Research would be enhanced if data was standardised and therefore portable across different analysis packages – particularly commercial image processing software tools. This is not currently the case and commercial providers seem reluctant to do this.
- BioImagingUK could potentially use its power as a 'big customer' to drive forward synergy and standardisation across research groups and communities to increase data portability – and perhaps to negotiate better academic discounts on software
- Should BioImagingUK strive to promote *open source* software analysis packages that do permit data standardisation and portability? RC could partner in this.
- Commercial providers could sell, for example, plug-in modules for an open source framework, focussing on their strengths in specific capabilities – rather than each commercial provider having to provide the "whole" image analysis package and environment, thereby forcing users to compromise on capabilities or to buy multiple (commercial) packages and wrestle with data portability issues.
- BioImagingUK should work to define the software and data needs are of the UK bioimaging community and perhaps reach a consensus on specific open source tools so that commercial providers are motivated to provide compatibility with these tools in their future product releases

Notes for National level facilities WP:

- For national level facilities there can be at least five potential important roles:
  - *Showcase for commercially available instrumentation*
  - *Provision of access to precommercial technology*
  - *Provision of access to central (expensive) facilities such as animal house, high throughput imaging facilities including, e.g. siRNA libraries, high-end EM microscopes*
  - *Development of and access to new technology beyond state-of-the-art and to combinations of technology (e.g. imaging across scales, multi-modalities)*
  - *Training of (non-specialist) users in advanced techniques*
- There was a range of views as to as to what was required for national (or regional) imaging facilities. Some thought that a central, national facility should be above and beyond what is cutting edge, perhaps with specific major technological goal(s). Others thought that access to expensive but established central facilities like animal houses would be useful for users from smaller universities.
- It was considered important to gauge community aspirations for national, regional and local capabilities - what facilities do/should universities already have? (Please can you add your existing imaging facilities to the list at: http://www.york.ac.uk/depts/biol/tf/imaging-cytometry/UK_LM_facilities3.html
- What capabilities would be better at a central facility and how many people would use them?

- What access should be provided to industry and what say should they have?
- It was thought to be important to involve life scientists from early on and not to leave planning and strategy only to instrumentation providers.
- It was suggested that residential accommodation would be important for users at a national facility
- Some expressed concerns that a national animal imaging might not make sense, in part due to time lines of experiments, animal housing issues, pathogens, Home Office paperwork etc. Others thought these challenges could be more efficiently addressed by a central facility although non-specialist users could also access animal houses from other universities.

Notes for Super resolution WP:

- National facility would have to stay ahead of commercial technology to be useful ⇒ would need excellent staff
- Training role would be valuable
- Risk of national laboratory becoming isolated
- Involvement of biologists is critical – but this should not become a biological facility

Notes for Electron Microscopy:

- Obvious candidate for national/regional facility
- Highest resolution is not necessarily top priority – need to gauge wants of user community – questionnaire under design
- Exciting opportunities with lower cost EM and correlative imaging with light microscopy
- National facility should provide access to technology that is not commercially available (or very expensive)
- Virtual "distributed national EM facility" could be useful

Notes for high throughput/high content analysis:

- Does UK need national/regional facilities comparable to EMBL? Regional facilities (e.g. one in London) maybe appropriate scale
- Significant cost savings possible with, e.g. central siRNA libraries
- Central training and help with data analysis/management would be useful

Notes for in vivo animal imaging:

- Need to marry imaging with animal house and biology expertise
- Virtual national centre may be appropriate model because there will need to be many animal facilities
- Central facility would have to deal with challenges associated with timelines of different experiments
- Challenges associated with OME Office licensing and Cat III pathogens
- Need multidisciplinary training courses
- Probably easiest to add light microscopy (multiphoton microscopy, optical tomography, endoscopy etc) to existing animal facilities where CT/MRI/PET already exist

Notes for Probes and Biosensors WP:

- Probes and biosensors are a vital part of most bioimaging experiments and can often present the most difficult challenge in terms of probe design, synthesis and labelling techniques. Any bioimaging centre must address this capability and probes can be the limiting step on correlative imaging and connectivity;
- There is currently a lack of access to biochemists who are needed to drive probe development forward.
- There is a need for networking and exchange of information/expertise in the probe and biosensor discipline, although it may be the case that some scientists not want to share their competitive edge. Sharing probes and, e.g. plasmids, is often a requirement of publication or a condition of public funding.
- There is a need for a comprehensive catalogue of what probes people have and can provide.
- The probes and biosensors WP document is going to be written by Tony Gee with help from Nick Long and Ramon Vilar – please contact them if you would like to contribute

Notes for Connectivity WP:

- RCs could fund equipment at universities with the requirement that some time is set aside by the host university for it to be used by external people and that this facility is advertised widely;
- Imaging across the scales/correlative imaging could be scientifically desirable but most institutions cannot afford to "do everything" ⇒ there needs to be some connectivity

(Lucy Collinson would like to know who does correlative imaging in UK – please contact her at lucy.collinson@cancer.org.uk)

- Should we focus on funding networking distributed capabilities or co-location of capabilities, e.g. at regional/national centres of excellence.
- Connectivity issues are also relevant to training, since there is a growing need for imaging scientists with experience of more than one modality. New strategies are needed for connectivity to work.

Notes for Training WP:

- All agreed that training should be an important component of Euro-BioImaging and BioimagingUK, with the potential to enhance connectivity and derive value from regional/national centres.
- Animal imaging would be an important topic for multi-disciplinary training programmes but there currently exist no such training programmes –although there are centres of expertise in animal imaging
- Training represents an important opportunity to secure funding from industry
- Members of the BioImagingUK are requested to inform Nick Long (n.long@imperial.ac.uk) of any existing training programmes

Notes for Careers WP:

- Advanced imaging instrumentation is of little use without staff that can operate it at and beyond the cutting edge. Bioimaging facilities cannot run only on post-docs and PhD students but need PhD level expert permanent staff to refine and customise imaging technology and to provide fully supported access to non-specialist users. It is important to attract high quality scientists into bioimaging and therefore to offer rewarding careers.
- The current situation is mixed with many imaging scientists expressing frustration at the lack of recognition of their work, limited career opportunities and relatively poor job security. This is a cause for concern given the number of PhD students and post-docs being trained in bioimaging.
- One issue is that facility staff often receive insufficient credit in terms of co-authorship on scientific publications. Technicians and scientific officers need to be listed as co-authors or otherwise appropriately acknowledged.
- Facility staff are often rewarded according to how many people they are managing and how much money they are bringing in, rather than their effectiveness at delivering a service. There was some discussion about appropriate metrics for bioimaging facility staff performance such as research output in terms of hours of use, and publications. It was felt that the bioimaging community could help determine suitable metrics for imaging facilities.
- Many considered that "scientific officers" represented the best career model and noted that research institutes tended to do a better job of providing career tracks for bioimaging staff than universities. This is partly because universities have more access to PhD students and fixed term post-docs – some of whom remain on a series of fixed term contracts for many years. It was noted that this is not just an imaging facilities problem.
- Should RC be encouraged to mandate universities to provide appropriate career tracks for bioimaging staff?
- It may be useful for imaging staff to be able to switch between academia and scientific officer career tracks;
- Should RC insist that bioimaging facilities have business plans associated with RC investments in instrumentation? This could help with career pathways, e.g. with regards to promotions and re-grading of staff in the future, and to sustainability
- Careers are linked to sustainability and training issues.
- There was some discussion of the EMBL model where the majority of staff has ~5 year tenure. This is an attractive career move for early career researchers who may then move into academia but can be less attractive for more senior people, who may not want to move their families or to leave significant instrumentation and infrastructure behind

Notes for Sustainability WP:

- It was generally agreed that access fees alone cannot pay for bioimaging facilities and that core/indirect support is also required. The notion that funding for facilities/big equipment should require a business plan as part of the application was reiterated. It was also suggested that when academics are funded to buy an instrument, it could be under the condition that the instrument is going into a central facility with a business case for others to access it;
- It was noted, however, that paying full economic costs (FEC) access charges to a facility would typically cost academics more than buying the equipment themselves.
- A need was recognised for bioimaging facilities to make more efficient use of the funding available, which would be easier if there was more flexibility. Currently many bioimaging facilities can't apply for new

equipment through grants, rather, the case for new equipment it has to go through a PI and will inevitably be a function of the PI's agenda. It was suggested that perhaps some funding should be awarded to facilities rather than individuals.

3. Sustainability of bioimaging facilities in the UK

Below is a summary of the discussion concerning the business models used to maintain current bioimaging facilities across the UK, according to their representatives at the meeting.

Central Laser Facility, STFC Rutherford Appleton Laboratories,

- Has core funding;
- Aims to provide external users with access to technologies they do not have at their own institutions
- No access charges
- If you get access to the facility, then you get funding for travel and accommodation
- Peer-review of proposals from potential users.
- Outside (user) guidance sought to develop facilities
- Staff recruitment is challenging because facility staff are perceived as not having much of their own research. This may be addressed by joint appointments with universities.

Electron Microscopy Unit, London Research Institute, CRUK:

- Core funded;
- 'Proof of principle' access or 'problematic' access with groups working together;
- Internal committee (of users) judge whether a project is feasible and the priority order of projects;
- Members of staff are core funded and come from academic backgrounds;
- Any papers need to go through the core service for checks on data interpretation etc.

Light Microscopy Lab, London Research Institute, CRUK:

- All users are trained to use the imaging equipment and then they simply book it, there are no user charges;
- It is sustained using core funding and is therefore free to use for all groups within the institute;
- For external researchers to gain access to use the equipment they must be collaborating with research groups at the Institute and the collaboration/research must bring in some value to the Institute – this is reviewed by a committee;

Bristol

- FEC is used to pay salaries for the facility manager/technicians and also for equipment maintenance costs;
- They always run at a loss, which is spread out between the departments;
- Loss is largely due to staff costs being included in FEC;
- Departments want to increase rate charges rather than pay top slice to cover loss

Dundee

- They have no core funding from the university
- Have £180,000 in staff (4 people) costs each year and a £200,000 maintenance service contract, both of these are covered by the Wellcome Trust;
- Competitive research grants are used to fund new equipment;
- All existing equipment was either bought on grants or donated to the centre;
- They have a three tiered charging mechanism (bronze, silver and gold), which is dependent on how much research income researchers bring in per year;
- Need external funding/grants to pay for everything else.

Southampton

- Sustained by FEC access charges (BUT not including salaries)
- Core funding from both the Trust and the College funds 4 staff in total (2 each);
- Their facility uses a mixed model with some core funding for staff costs, but also access charges to fund everything else;
- 30% of FEC is put aside for replacement of equipment in the future.
- The whole thing is overseen by a committee

Imperial College Centre for Bioinformatics

- Imperial has tried different models over the years
    1. Fixed charge per year for using facility – didn't work
    2. Top-slicing – loathed by HODs and research groups
    3. Touting for business to pay staff costs – she now asks people to include her 4 staff as a % cost on their grant applications.
- FEC does not solve the core infrastructure problems of any facility - not just imaging facilities.

York

- They charge for per hour using the instrument plus staff time;
- No core funding;
- FEC includes salaries;
- Access charges are lower for the high usage instruments, than for the less frequently used instruments;
- The minimum units of charge/time are different for different pieces of equipment;
- Over 8 hours of usage is not necessarily charged at multiples of unit usage, there is sometimes a set fee for 8+ hours;
- Some PIs say they would prefer a yearly access charge rather than unit charges;
- Structured charging costs are essential;
- York's facility doesn't make a loss – talk to Peter O'Toole for more information.

Newcastle

- 25% core-funded, 75% costs recovered from access charges
- Academics sometimes make arrangements to use other academics' instrumentation rather than pay access charges to facility

Summary of review of sustainability of bioimaging facilities:

- Universities – most places have an element of core funding but also have access charges.
- Institutes – equipment is often free to use and the researchers at the Institute don't ask about the cost of facilities in the same way that academics at universities do.
- A major issue is that one cannot include depreciation of equipment into FEC (except for large items).

4. Delivery of "premier league" imaging?

There was a short discussion concerning which capabilities should be in national/regional facilities but no clear consensus was reached. EM, super-resolved microscopy, high throughput/high content imaging and animal imaging were all seen as facilities that institutes and larger universities would want locally but which could also make sense in national/regional facilities, particularly when training and "try before you buy" issues were considered.

Final points:

- A difficulty for BioimagingUK and Euro-BioImaging is that most decisions about investment in bioimaging facilities are made at a local level. This has resulted in the UK failing to lead internationally with respect to large scale "Grand Challenge" imaging projects such as "MitoCheck".

- To date, bioimaging facility staff have engaged more proactively with BioimagingUK than UK academic research group leaders – although some have participated. Going forward it is important to more fully engage academic research group leaders and to continue to engage research sponsors.

- Once the strategy document is written, there will probably be more interest from the academics, particularly when they observe the engagement with research sponsors.

- The EM WP group are writing a questionnaire at the moment to obtain opinions and real data about bioimaging facilities (e.g. % unutilised facilities). This questionnaire could be extended to include aspects of sustainability, connectivity and training etc, with questions concerning different techniques and WPs addressed in different sections.