Strategic Planning for Biological Microscopy at Oxford University

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1. Introduction

Microscopy is a rapidly evolving research tool that is of importance to many branches of biological research. Oxford University has outstanding microscope equipment and technological know-how, which is spread over many labs, facilities and departments. Much of this equipment is now catalogued in the Research Facilities Database (RFD). Rapid technical advances mean that microscopy is constantly changing, leading to a continual demand for ever-more sophisticated and more expensive equipment.

There is now increasing pressure from funding agencies on large Institutions like Oxford to coordinate its applications for expensive microscopes. Such coordination makes sense. At Oxford, for example, a search of the RFD (https://www.research-facilities.ox.ac.uk) with the term "confocal microscope" returns 49 results; yet Oxford scientists continue to apply for funds to purchase new confocal microscopes. The funding agencies are right to insist that larger institutions put in place robust mechanisms to ensure the best use of their existing microscopes and a coordinated assessment of their future needs.

I was asked to consider how Oxford University might accomplish this. In this report, I suggest some possible ways to do it.

2. Background

In 2006, Professor Peter Jezzard produced a report that catalogued existing imaging equipment at Oxford in both the biological sciences (mainly light and electron microscopy) and the medical sciences (mainly MRI, PET, and SPECT). The report made a series of recommendations for how the University could ensure better coordination and communication within the imaging community, primarily through the Imaging Management Board (IMB) and the Oxford Biomedical Imaging Network (OBIN) (http://www.imaging.ox.ac.uk). The IMB considers issues related to both basic and clinical biomedical imaging and organises an annual one-day Imaging

Festival designed to promote the exchange of ideas within the wider Oxford imaging community (http://www.imaging.ox.ac.uk/activities/annual-festival). This meeting is deemed to be very successful. The OBIN website provides links to groups in Oxford involved in basic and clinical biomedical Imaging and to various resources, including imaging facilities and lists of equipment. This site currently receives no central support and is personally maintained by Peter Jezzard.

The recent cataloguing of all major pieces of equipment at Oxford for the RFD now provides a more up to date source of information about existing imaging equipment within the University. Crucially, resources are provided to ensure that this database is constantly updated. Nevertheless, the database gives only limited information about the level of technical support available with each piece of equipment and how the equipment can be accessed. Moreover, it is not set up to assess future needs or to coordinate efforts to meet such needs.

While compiling this report, and through my involvement with Oxford Micron (the new, Wellcome-Trust-funded Advanced BioImaging Unit headed by Professor Ilan Davis), I have become aware of the extraordinary efforts aimed at developing new imaging technologies at Oxford. Much of this development is going on in the Maths and Physical Life Sciences Division (MPLS) — in the Departments of Engineering, Physics and Chemistry. I suspect many Oxford biologists who use high-end microscopes have little knowledge of this effort, and there is a need for more effective communication between technology developers in MPLS and the more biology-oriented users in the Medical Sciences Division (MSD). Improving this communication will be increasingly important as we bid for new imaging equipment, especially as larger bids are likely to include elements of technology development. Indeed, the University recently put in two such bids to the MRC's "Next Generation in Optical Microscopy Initiative".

Whereas Peter Jezzard's original report dealt with both microscopy and clinical imaging, in this report, I deal only with strategic planning in microscopy.

3. Proposals

The proposals outlined here are based on views that emerged from a meeting (that I chaired) with academics and facility managers involved in microscopy from both

MSD and MPLS (see Appendix I for list of attendees). In this meeting, we discussed two major questions: How can the University ensure that it has an effective strategy to assess and coordinate future microscopy needs? How can the University ensure that it is making the most effective use of its existing pool of microscopes and technical knowhow? I will deal with these in turn.

3.1 Proposal 1: strategy to assess and coordinate future microscopy needs

We propose to establish a **BioImaging Coordination Group (BCG)**. Its remit will be to ensure effective communication between technology developers (largely based in MPLS) and technology users (largely based in MSD), as well as to assess future imaging needs and to agree the best strategy for coordinating efforts to meet these needs. It will consist of one to three academics with an interest in microscopic imaging from each relevant Department in both MSD and MPLS (approximately 15-20 people in all).

The BCG will meet once a year. A short presentation from each Department will highlight its imaging facilities, uses, technology developments, and future needs. This will be followed by a general discussion to agree on future priorities and strategies to achieve them. This process should considerably strengthen future grant applications by ensuring that applicants coordinate their efforts and match their choices to the needs of the widest possible user base within the University.

In practice, the skeleton of such a committee already exists in the management committee of the recently formed Micron Oxford Advanced Bioimaging Unit, which is funded primarily by a Wellcome Trust Strategic Award. This committee tries to promote a multidisciplinary approach to high-end microscopy, and its has substantial representation from the Departments of Biochemistry, The Dunn School of Pathology, DPAG, Physics, Engineering, STRUBI and the WIMM. Indeed, it can be argued that Micron Oxford largely fulfils one of the major recommendations of the original Jezzard report — that a “virtual” Biomedical Imaging Sciences Institute be established with researchers from MSD and MPLS. Clearly, however, the BCG must be independent of Micron Oxford, although several members are likely to serve on both committees.

The BCG can also be convened at short notice (most likely through e-mail) to discuss relevant grant applications with tight deadlines. It is crucial, however, that BCG does not hinder scientific progress: individual groups and Departments must be free to apply for whatever funding they think appropriate, without the need for BCG approval. It is envisaged that the BCG will strengthen future bids by ensuring that all bids are properly discussed by all interested parties.

It will be important to decide to whom the BCG reports and how its activities will be coordinated with the existing IMB. I have discussed these issues with IMB's Chair, Peter Jezzard. The IMB currently reports to the Regius Professor and the Division Heads and Secretaries in MSD and MPLS. **We recommend that BCG also reports to them and that both additionally report to the PVC for Research (currently Ian Walmsley) and the Chair and Institutional Representative of the Institutional Strategic Support Fund (currently Ian Walmsley and Peter Ratcliffe, repsectively).** The IMB has a strong medical slant and would be expected to make strategic recommendations in clinical imaging. **To ensure coordination, the Chair and Vice Chair of the IMB should sit on the BCG and vice versa, and each committee will exchange meeting minutes for note.**

A further recommendation is that **someone from the Finance Division should attend BCG meetings**. Tim Frost from this Division participated in the initial meeting to discuss these proposals, and this was considered very helpful. The purchasing team are aware of all on-going negotiations between the University and equipment suppliers, and there may be considerable scope for obtaining better deals if we can coordinate our efforts across the University, particularly for service contracts. Moreover, the University is currently negotiating the possibility of establishing special working relationships with several microscope companies, and the involvement of both the Finance Division and the BCG should be helpful in these negotiations.

3.2 Proposal 2: strategy to make the most effective use of existing equipment

We propose to establish a **BioImaging Facilities Committee (BFC), which** will report to the BCG**.** Its remit will be to ensure that Departments that use microscopes are kept up to date with the equipment and expertise that is available in other Departments. Departments vary greatly in the numbers of microscopes and

microscope-users: at one extreme, are those with many users and a microscopy core facility run by salaried members of staff; at the other, are those that have only a few microscopes, which are associated with individual groups. It is especially important that researchers in the latter Departments are informed about microscopy facilities available elsewhere in the University and how they can gain access to them.

The BFC will consist of the one or two representatives from each relevant Department who are most involved in the day-to-day operation of microscopes (approximately 15-20 people in all). It will meet once a year. A representative from each Department will give a short presentation about the microscopes and expertise available in their Department, and whether and how researchers outside the Department can access these. The representatives will also report on what technologies the users in their Department are most interested in acquiring, which will be reported to the BCG.

The BFC will also try to rationalise access charges across different Departments and Facilities. Currently, these vary widely, which is a significant problem. There is also variation in, and some confusion about, the level of access charges funding agencies will support. Rationalising these costs within Oxford should strengthen the case for funding these costs in future grant applications.

From discussions with academics and facility managers in different Departments, it is clear that some University microscope resources are not being used to their full potential. The BFC should ensure that the microscopy needs are more efficiently matched with existing equipment and expertise. It will inform the BCG of any unmet needs, so that the BCG can take this into consideration in their strategic planning.

4. Other issues

4.1. Data storage and sharing

As microscopes get more sensitive, sophisticated, and faster, they are generating ever-increasing amounts of data, which need to be properly stored, backed-up and archived. Currently, each Department usually has its own solutions, and these vary widely in quality, depending on the hardware, software and technical staffing. Data

storage demands are not unique to imaging: DNA sequencing, proteomics and bioinformatics, for example, all have similarly increasing demands.

Data storage would seem to be an area where a coordinated approach could add efficiency and save costs, but from my initial discussions it is clear that this will be extremely challenging, costly, and potentially dangerous. One sensible approach may be to encourage Departments to develop their own solutions, in partnership with other Departments where possible, but to ensure that best practices are effectively communicated across the University. I am loath to suggest the formation of yet another committee, but an annual meeting between the heads of IT in each Department to discuss these issues would probably be useful.

4.2. An Oxford Imaging website?

As discussed above, Peter Jezzard currently maintains the Oxford Biomedical Imaging Network (OBIN) website, which is invaluable for organising the Imaging Festival. Not surprisingly, given the pressures on his time, it is proving difficult for him to keep this resource up to date. The equipment inventory assembled for the RFD has obviated the need for the OBIN website to act as a source of information about the University's microscope equipment. Nevertheless, there is considerable support within the imaging community for an Oxford Imaging Website to serve as a first port of call for anyone interested in imaging at Oxford. This could be implemented either by providing proper core support for the OBIN website or (in agreement with OBIN), by amalgamating at least parts of the OBIN and Micron Oxford websites.

The first solution would cost very little, but the latter might be more beneficial. Light microscopy is entering a new and exciting era, with many new techniques allowing unprecedented resolution and precision; a new website to promote Oxford as a centre for these techniques would be useful. It could eventually be developed along the lines of the **Instruct** website (http://www.structuralbiology.eu), which is an invaluable resource for the structural biology community.

Appendix I

List of People Contacted about Meeting (those attending highlighted in red)

Ian Walmsley (Physics)
Xianmin Jin (Physics)
Achilles Kapanidis (Physics)

Peter Holland (Zoology)
Sebastian Shimeld (Zoology)

Tony Wilson – (Engineering Science)

Kay Davies (DPAG)
Simon Neil (DPAG)
Shankar Srinivas (DPAG/Micron)

Gero Miesenboeck (CNCB/DPAG)
Scott Wadell (CNCB/DPAG)
Brian Patton (CNCB)
Martin Booth (Engineering/CNCB/DPAG)

Xin Lu (Ludwig Institute)
Mark Shipman (Ludwig Institute)
Colin Goding (Ludwig Institute)

Enzo Cerundolo (WIMM)
Doug Higgs (WIMM)
Veronica Buckle (WIMM)
Christian Eggeling (WIMM)

Yvonne Jones (STRUBI/WTCHG)
Kay Gruenewald (STRUBI/WTCHG)
Dave Stuart (STRUBI/WTCHG)

Antony Galione (Pharmacology)

Nigel Emptage (Pharmacology)

Chris Garland (Pharmacology)

Ian Dobbie (Biochem/Micron)

Ilan Davis (Biochem/Micron)

Jordan Raff (Dunn School/Micron)

Alan Wainman (Dunn School/Micron)

Tim Frost – (Finance Division)