How to set up and run a surgical research laboratory

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Abstract

Laboratory fundamental science research has lost prominence in recent years, with alternate academic careers paths being available to surgeons. Strengthening fundamental science in surgery has never been so vital and so this article sets out to discuss the steps needed to set up and develop a surgical research laboratory.

INTRODUCTION

A surgical investigator is a bridge tender, channelling knowledge from biological science to the patient’s bedside and back again. He traces his origin from both ends of the bridge. He is thus a bastard and is called this by everybody. Those at one end of the bridge say he is not a very good scientist, and those at the other say that he does not spend enough time in the operating room. If only he is willing to live with this, he can continue to do his job effectively.

Francis D. Moore MD [1].

Surgical research has shifted from the laboratory focus of the mid to late 20th century to a more mixed economy of data science, collaborative and qualitative research, with a gradual decline in more ‘fundamental’ science research. Many of the advances in surgical science over the past 70 years have come about through translation of fundamental science discoveries to their use in surgery. For instance, solid organ transplantation [2] combined developments in pharmacology, immunology and haematology in order to make what once seemed impossible (the stable transplantation of an immune mismatched organ) into a host. Similar advances have come about in laparoscopic surgery [3], joint prostheses [4], deep brain stimulation [5] and surgical oncology [6] where a clear surgical need to improve care has been complemented by a strong fundamental science base, with a surgeon as the leader in this role. Funders now acknowledge the need for strong translational science and are actively attempting to recruit surgical academics into these positions. In this article, I will discuss some of my experiences and opinions of how to best set up and run a surgical research laboratory. As my colleagues, members of the lab and the university will tell you, these insights come more from making every mistake possible, rather than doing everything right the first time. Much like surgery, progression in academia seems to be mainly due to a combination of working hard with being in the right place at the right time in order to progress, and a lot of luck!

CAREER PATHWAYS

The UK Foundation [7] and specialty training [8] programmes have introduced academic training programmes for early (PGY1/2) and late (PGY3–8) doctors in training in order to foster an academic career, with a clinical research fellowship, typically leading to the award of a PhD and funded by an external partner sandwiched between these two programmes. Many research careers start with an intercalated research degree, done at some stage in basic medical training and leading to the award of a BSc/BMedSci degree and the publication of research papers.

My own experience, however, is significantly different, having being trapped in the no-mans-land of the Medical Training Application Service (MTAS; c. 2007) [9], having done an intercalated degree but not intending to become an academic, the devastation caused by MTAS lead to an unexpected diversion into research. Certainly, the majority of current research careers have not taken place along the conventional ACF/PhD/pathway...
and research can be entered into at any point along the career pathway, but a higher research degree (preferably a PhD) is a prerequisite for entry, much as the MRCS is for the progression to higher specialist training and the FRCS is the completion of specialist training. Additionally, several universities offer funded MB/PhD programmes, which offer a rapid route into academic medicine for those committed at an early stage.

Whichever route is taken, it is vital to build up the credibility to start a laboratory or research group based on a track record of funding, published papers and academic reputation in an institution that will support you and your academic career. Surgical academics are very much in the minority now and continue to dwindle in number due to the perceived unattractiveness of an academic career to surgeons.

WHEN AND HOW TO START YOUR LABORATORY OR RESEARCH GROUP

The majority of laboratories or research groups will start either towards the middle or end of specialist training or at the award of CCT, within an academic institution. It may well end up as a natural continuation of a career pathway undertaken with the institution where you carry out your higher degree, as the academics within that institution understand your research and its direction and can support your development. Alternatively, several core funded UK institutes, for example the UK’s Crick Institute, offer both junior and senior clinical group leader positions and actively attempt to recruit to them. These positions offer the opportunity for core funded support (meaning the need to continually write grants for funding is less), dedicated posts and space to work. These positions are highly competitive, requiring high impact, first/senior author publications and a track record of research. University research groups offer an alternate route in, usually via an academic clinical lecturer position or alternatively via a funded fellowship that will support the setting up of a lab. Although the competition for entry to these positions is different to a core funded institute, the degree of effort required to maintain the grant funding and papers to keep that position can make this route considerably more challenging than a core funded position in the long run.

Whichever route inwards is taken, it is usually best to enter into that institution with the support of a complementary research group to your own chosen field, which can nurture your own research interest as part of a larger group until you are ready to strike out on your own, much in the way a postdoctoral fellowship works in conventional science funding. Precisely timing when the transition to independence should occur is difficult and may happen either organically (as funding is obtained) or sometimes by circumstance (retirement of a group leader).

WHAT DO UNIVERSITIES WANT?

Universities are like any other business and have priorities that usually do not align completely to yours. Unlike core funded research institutes, the primary duty of a university is to undergraduate and postgraduate tuition and considerable pressure is usually put on you to play a role in this teaching. It is important to engage fully with teaching at a university position as this will form part of the evidence needed to convert a temporary research fellowship into a tenured permanent group leader position. If you are fortunate enough to join a core funded research institute, you may not have to do any teaching, which in itself is a shame as this is a key part of academic surgery.

Universities also act as research institutes, but despite changes to government funding methodologies (TRAC) do not make any profit from research and indeed may lose money on research undertaken funded by charities as the income recovered from this may not always cover the ‘full economic cost’ (FEC) of the research. FEC covers things like the buildings, lighting, heating and administration of the university (which are known as indirect costs of research) and only governmental funding provides the FEC of a research grant and is much preferred by a university to charitable funds. This is why teaching is prioritized, which will always generate an income stream for the university, even though the research stream will inevitably be higher profile and lead to more ‘impact’ to the university in terms of publications, prestige and media attention. The more grants you can secure the better, and the best strategy is to secure a number of smaller grants building up a field of research leading to the ‘pinnacle’ of a programme grant in your topic of interest rather than struggling to generate the data you need for that big application.

Finally, universities need administration like all others, and as academics we are expected to sit on committees, design and monitor teaching and undertake improvement of the university as part of our duties. This is also vital to your career and is known as ‘citizenship’ in universities and gets you seen by the people who will be making decisions on whether to support you for a permanent position in your institution, and so it is vital you engage in the process as much as you are able.

THE CLINICAL-ACADEMIC DICHOTOMY

So-called ‘craft’ specialties, such as surgery, occupy a special niche in the academic pantheon, as the demands of both the clinical and academic sides of your career can be very demanding. This is even more pronounced in fundamental science laboratories where running a research group means you need to be physically present to lead the group, undertake and supervise research. Unfortunately, this can lead to the situation where you are perceived by your clinical colleagues as not spending enough time operating and by your academic colleagues as not spending enough time in the lab [1]. This can be a very difficult balance to achieve, and there may be times where you spend more time doing clinical work and more when you do more academic work, but what is vital is to have supportive colleagues (as I have) who understand and support clinical academics both in the hospital and the university. Without this, it will be very difficult for you to progress so your institution should be chosen very carefully.

WHAT YOU NEED FOR A SUCCESSFUL LAB

I wish I could tell you that there is a magic set of ‘things’ that you need to run a research laboratory successfully but from my observations this will differ widely depending on the group leader (you), the academic institution, the hospital and the funding landscape you work in. A lot of this depends on your personality and those you work with, and is really like a complex jigsaw puzzle that can take a while to assemble. Also, it is difficult to define ‘success’ as it means different things to different people, with the most important thing probably being that you feel happy and satisfied with what you are doing. However, what follows is a number of things that I have found really helped:

I have found the most useful starting point is an experienced postdoctoral fellow, who is brought into the lab early (ideally when you start it), shares your goals and helps you build up
the lab over the time it takes to develop it. I have been really fortunate to have had several of these vital people come into my lab over my 14 years in academic surgery. The most important characteristic I have noted is someone who is not afraid to challenge your beliefs and tell you when you are wrong (because you frequently will be) as well as help steer the ship if you have to spend time in clinical practice. Of note, for those in academic clinical lecturer positions, I have noticed that this works best when there is an equal split in a working week of academic and clinical time. Blocks of academic and clinical work do not work in my experience and detract from what is meant to be a fusion of clinical work and academic, not rotations. You cannot leave a lab running whilst you spend 6 months in full-time clinical practice as the lab will simply wither on the vine.

Collaboration is vitally important, and you should try to explore what your peers within your own institution are doing and build bridges with them, as in my experience they may take you in unexpected directions that will significantly enhance, rather than distract you from your research programme. Raising your profile via attendance at academic conferences and social media is vital in the modern world, as it is no use having the best research in the world if no-one knows about it, nor is it good to have a profile if you don’t have any research to back it up with.

A steady publication pipeline is also important as well (publish or perish), and although the pinnacle of fundamental science is seen as a Nature, Cell or Science paper, the reality for most of us is a series of lower impact, but still vitally important, papers that tell a story over time, which in the end may be more highly cited than the highest impact factor papers and provide the strongest case for continuing funding. The San Francisco Declaration on Research Assessment [10] has been adopted by almost all funders and makes the important point that research must be impactful, rather than having a high impact factor. There are two points that I hope back up my argument, namely that ~5% of papers published within Nature are cited more than 5–10 times after publication [11], and that the recent Nobel Prize winner, Prof. Sir Peter Radcliffe, had his seminal work on hypoxia rejected by Nature as not of ‘sufficient interest’ in 1992 [12].

Finally, mentorship and peer support are also important. These terms are used a lot in surgery, but I would suggest that once again, they can only arise organically and only you can choose the right people. You will need an academic mentor and peer, as well a surgical mentor and peer. My academic mentor came from my PhD, and although he has been long suffering in his support of me, has given me invaluable advice throughout my career. Having an academic peer who you can go to for moral support in dark times, when the research income and papers dry up is also vital. For clinical mentorship, these people can come from the least expected places, my clinical mentor being a consultant who supported me through some of the most difficult times in my specialist training rather than an academic surgeon. For clinical peer, it is really important to choose a colleague (at whichever level) who can support you when the demands of the lab may mean you need help with your patients, and you can repay the favour to with support when they need it.

CONCLUSIONS

Reading this article may make you feel that a surgical academic career in fundamental sciences not for you. I have found nothing more satisfying than combining love of scientific discovery with the ability to take this science and really change the way patients are treated. I have been fortunate to been given opportunities to meet new people and go to new places, be exposed to new systems and practices that I would never have been if I had stayed in clinical surgery or a different aspect of academic surgery. It has expanded my horizons considerably, and we vitally need more surgeon scientists to give the translational perspectives in research that are currently not as prominent as they should be.

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CONFLICT OF INTEREST STATEMENT

None declared.

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