1 Introduction

Aims of this book

This guide was written primarily for medical students and practitioners considering whether to attempt a programme involving original research in the medical and biological sciences. The author who initiated this text (George Murrell) read for a medical degree, did a stint in research and has now returned to clinical medicine (orthopaedic surgery) with an academic interest. He was then joined by two others, one of whom (Christopher Huang) first qualified in medicine and has subsequently remained in research, and another (Harold Ellis) who has had a primarily academic clinical career. In this third edition, they are now joined by Juliet Usher-Smith, who completed a combined MB/PhD programme and is now at the early stages of combining clinical practice with research. Accordingly, the authors themselves represent the major groups and career stages of people who do medical research.

Individuals have different reasons for wishing to do research, which include gaining a higher degree, furthering their medical career or simply taking a break from clinical practice. Such a pursuit can be incredibly exhilarating and rewarding. Alternatively, it can be an endless, lonely, boring and frustrating exercise. The aim of this handbook is to guide the potential medical postgraduate candidate away from the latter predicament. It is not intended to dictate the researcher's own originality, creativity or scientific

approach. Rather, it is organized around a sequence of practical steps directed at the more pragmatic questions:

'What steps do I take?'
'When and where do I start?'
'How do I get to the end of the tunnel?'
'What do I do next?'

We thereby hope to alleviate unnecessary anxiety and save the reader valuable time and energy that could then be used in a more productive way. We have accordingly set out much of the text in a simple, didactic format.

Much of what we outline will be simple common sense, but we hope that our presentation will enable the potential researcher to pick out 'the wood from the trees' and assist the reader to his or her task with greater efficiency and confidence. Our comments are directed largely at doctors undertaking clinical or experimental research. However, the basic principles of maintaining an effective individual research programme are also applicable to those pursuing Public Health or Primary Care research and those in purely scientific careers.

It is worth pointing out at this stage that the focus for this book will be on research as opposed to audit. Although the distinctions between the two are often blurred, research involves developing and testing new hypotheses in order to advance our knowledge and understanding of a specific topic, whereas clinical audit is a quality improvement process that aims to improve patient care and outcomes by carrying out a systematic review of current practice against established guidelines and implementing change. Whilst becoming involved in audit can therefore be a useful prelude to research, the process itself is quite different.

Outline

This guide is organized in the chronological order of the steps most doctors take when pursuing a research programme. Everyone first has to decide whether he or she wishes to pursue research

and then, if the decision is made to enter research, the decision of when to embark on it must be made. The next stage of choosing a research degree, a supervisor and a project and applying for research positions is perhaps the most critical. After that, all research programmes tend to follow the same pattern. Following the necessary background preparation in the area to be studied, one establishes and develops methods to be used in the research project. Time is then needed to assess the limitations of these methods and to develop one's experimental skills to a level where they yield valid results and overcome the inevitable frustration. There then follows serious hypothesis testing and obtaining and analysing results. Finally, the results are written up and communicated, either through publishing papers or presenting at scientific meetings and, ultimately, in the form of a thesis and/or a *viva voce* examination.

The time and emphasis bearing on each of these steps varies with person, project and research supervisor. In particular, the prominence of the phase of frustration depends largely on the circumstances and the good or ill fortune of the investigator. In addition, the time taken to write up the thesis or research papers varies greatly, tending to increase sharply with the total time set aside by the doctor for research.

Summary

- Research in Medicine is, for the most part, exhilarating and rewarding, but without adequate planning and support it can be an endless, frustrating exercise.
- This book aims to provide practical advice for anyone considering medical research.
- This book is organized in chronological order, from deciding whether to do research through the planning stage to writing a thesis.

Great potential for disasters . . .

2 Deciding whether to do research

Research experience is increasingly important in today's fight for jobs and so the aspiring clinician may leap, somewhat reluctantly, into a research programme without carefully assessing its processes, outcomes, advantages and disadvantages. Some considerations as to whether or not one should do research at all are presented here.

The challenge

Research by its very nature offers a tremendous intellectual and personal challenge and has the potential to unearth information that may help the wider community.

Becoming a better clinician

A number of desirable qualities are necessary for, and consequently, developed in, research. These include an open, inquiring mind, logical thought, careful analysis of previous research with a mild degree of scepticism, an understanding of the processes necessary to achieve the presented result, self-discipline and self-sufficiency. It can be argued that many of these are also of considerable value in clinical practice. Almost any established clinician who has spent time in research during training, whether they are surgeons in district general hospitals, physicians in private practice or general practitioners, will tell you that they regard

themselves better doctors as a result of this experience. They find themselves more able to analyse a clinical problem, appraise the results of their management of patients and assess objectively the latest claims from scientists, colleagues and pharmaceutical companies because of their exposure to the scientific method.

As part of an academic career

Without doubt, research achievement, including a higher degree by thesis, is essential for a career in academic medicine. Most people who decide on a career in university medicine do so from an interest in research and teaching; it is not invariably true, but it is surprising how often the two do go together! It is a hard fact that subsequent promotion in such a career depends on a proven research record with relevant publications in reputable and refereed journals.

Competing in the job market

Selecting one applicant rather than another in appointments for medical jobs has always been a difficult process. The ability to conduct research and publish research papers has become an increasingly important factor, even in non-academic medicine. There are now sections on presentations and publications in all the application forms at all levels and an expectation that all doctors will, at some point in their career, be involved in research. Several good papers in reputable journals consequently serve a candidate well for future employment. However, one must remember that two or three years in an unproductive pursuit of research away from any clinical experience, leading to a few esoteric papers in obscure journals, may not enhance your status with future employers.

Fame

Potential for fame arising from ones' research findings on a small scale is reasonably good. You might find yourself making

significant new discoveries, getting a difficult assay to work or solving a theoretical problem. However, to reach great heights requires years of dedication, insight and luck, and there is great potential for disasters (unsuccessful projects, infected cultures, broken glassware and machinery, etc.) and wasting months or years in the pursuit of what seems to be an endless, unsolvable problem.

Lifestyle

If you want continual reassurance and direction, research is not for you. Self-assurance, independent thought and the willingness to take a chance are valuable in research. The working day is structured by you, not your employer, but this does leave greater freedom for other activities. This increased flexibility may be a particular factor for female doctors planning to have a family or wishing to work part-time. However, the distinction between work and rest is less clear and there is great pressure on you to work at home and at weekends. Monetary rewards while in research are also generally less than in clinical medicine.

Summary

- Think carefully before embarking on medical research.
- There are many different reasons for wishing to do research, including to become a better clinician, gain a higher degree, further your medical career or simply take a break from clinical practice.

Less clinically applicable . . .

3 Deciding when to do research

Biological scientists not proceeding to do medicine usually attempt their higher degrees immediately after their first degree, often continuing an interest arising from an honours degree project. Others return to university after a time working in industry. Medical students or doctors have a number of options, each with particular advantages and disadvantages. These relate both to the implications of taking 'time out' for research on future medical career prospects, and to the effects of this timing on the academic quality of the research. The main options for timing of research in medicine are:

1. Prior to medical training.
2. During undergraduate medical training.
3. Between undergraduate medical training and starting clinical work.
4. During clinical training.

Ultimately, the choice of when to do research will depend on a large number of both personal and professional factors and what is 'best' for one person may be very different from what is 'best' for another. Here we consider some of the advantages and disadvantages of the various options. Much of the text here relates to medical students and doctors within the UK, but details of the differences in other countries are included at the end of the chapter.

1. Prior to medical training

Research after a basic science degree may be very helpful for gaining entry to medical school, and often sets the groundwork for each of the later steps.

2. Research during undergraduate medical training

A year or more of research taken during undergraduate training, leading to a BSc, MPhil or PhD, is a well-recognized step in many universities. Indeed, this is often actively encouraged for the more successful students.

A number of medical students become sufficiently interested in basic sciences, or at least particular aspects of them, before they begin the clinical component of their undergraduate course. This is particularly so if they have read for an honours degree, or have included an intercalated BSc as part of their basic medical course, and feel they would like to proceed directly to completing a research degree before their clinical course. Under such circumstances, you have the advantage of having basic scientific concepts fresh in your mind and this can be helpful, at least at the beginning. Doing your research at this stage also avoids disruption to clinical training later. However, your research may be confined to experimental scientific work. You may have neither the knowledge of, nor the access to, a clinical environment or clinical resources, except under very particular circumstances determined by the interests and background of your supervisor. You will also have to complete your work within a strict time limit in order to rejoin your medical course, at the appropriate point in the academic year. Clinical schools are often helpful and understanding to those who wish to take time out before their clinical studies. However, deferral is necessarily for a fixed time, limited by the start of the academic year. It is also more than likely that the area in which you pursue research will have little or no relationship to your eventual interests, as you will not have had opportunities to explore your options in the clinical field at either the undergraduate or postgraduate level.