

The Cambridge Bachelor of Medicine (MB)/Doctor of Philosophy (PhD): graduate outcomes of the first MB/PhD programme in the UK

Timothy M Cox, James Brimicombe, Diana F Wood and D Keith Peters

ABSTRACT – We reviewed outcomes of the Cambridge Bachelor of Medicine (MB)/Doctor of Philosophy (PhD) programme for the period 1989–2010. Of the 90 alumni contacted, 80 (89%; 24 women) completed an anonymous questionnaire. Thirty were academic staff and 35 were in general professional (core) or higher medical training. Of the latter, 11 were specialty registrars, six were academic clinical fellows and three held academic foundation year posts. Eight alumni were overseas, including five in North America. Most (95%) respondents considered that their academic career goals were facilitated by the programme. Sixty-eight of the 80 alumni had conducted further research, 63 (79%) were active in research, and 90% had explicit plans for further full-time research. Twelve graduates had further substantive research support (six clinician scientist awards and three senior fellowships) and two were Wellcome Trust postdoctoral MB/PhD fellows. Alumni included two full university professors, one reader, six senior lecturers, two assistant professors and nine university clinical lecturers. MB/PhD programmes offer an alternative training pathway for clinician-scientists in UK medical schools: the Cambridge programme promotes scientific discovery and sustained academic development within the context of contemporary medicine and clinical practice.

KEY WORDS: clinical academic, MD/PhD, postgraduate, research, training

Introduction

Medical graduates who wish to pursue a research career require long periods of scientific training combined with clinical practice. Rapid changes in the National Health Service and radical reforms in medical training and contractual initiatives, with increasing competition for long-term substantive research funding and

training posts, are challenges for clinical academics – these issues particularly affect procedural specialties, including surgery.

Doctor of Medicine (MD)/Doctor of Philosophy (PhD) programmes have long been established in North American medical schools to enhance recruitment to academic medicine.¹ These programmes focus on clinical investigation, especially translational research, which is perceived as a requirement for innovation in medical practice. The medical scientist training programme (MSTP) in the largest public university in the USA, the David Geffen School of Medicine, University of California (UCLA), has 150 graduates, 70 of whom are academic physician scientists. Comparable educational investment has been called for in the UK to populate translational science within the clinical training environment.²

The Cambridge Bachelor of Medicine (MB)/PhD programme was the first to be incorporated formally within a traditional European clinical curriculum.³ It is one of three options for clinical medical education in Cambridge and currently extends for nine years from matriculation. Three years of full-time research are integrated within the standard undergraduate clinical course, which combines a preclinical programme that focuses on core medical sciences; a compulsory third year leading to a bachelor degree; and a clinical course with emphasis on linking knowledge with clinical, practical and communication skills and attitudinal and professional development. During the research period, integrated clinical studies continue in the form of weekly bedside teaching supplemented by seminar and tutorial teaching in clinical medicine. After submitting their PhD thesis, MB/PhD students return to full-time clinical teaching for two years to obtain MB/Bachelor of Surgery (BChir) degrees.

The MB/PhD programme is open to students from all medical schools in the UK, subject to acceptance on the Cambridge clinical course. Applicants require an honours degree of at least 2:1 grading in medical sciences; there is an additional application and interview. The Medical Research Council, Wellcome Trust, Department of Pharmacology and Trinity College, Cambridge, provided research studentships for the first seven years of the programme. Since 1997, support has come from diverse external charities and trust funds, including internal studentships from colleges, university departments and affiliated institutes in Cambridge. A management committee oversees timetabling, clinical placements and academic performance. In annual symposia, programme students present their scientific

Timothy M Cox,¹ professor of medicine and director, MB/PhD Programme; James Brimicombe,¹ data manager; Diana F Wood,² director of medical education and clinical dean; D Keith Peters,² regius professor of physic emeritus

¹General Practice and Primary Care Research Unit, Department of Public Health and Primary Care Institute of Public Health, Cambridge;

²Regius Professor of Physic Emeritus, University of Cambridge School of Clinical Medicine, Addenbrooke's Hospital, Cambridge

work to peers, external guests, academic stakeholders and charities.

To ascertain the effects of the MB/PhD programme in the 21 years since its introduction, we examined the outcomes of a cohort of its graduates using indicators including the proportion that has obtained support for postdoctoral research, their record of scientific publications and their desire for, and ultimate success in obtaining, academic appointments.

Methods

We report the outcomes of students on the MB/PhD programme between 1989 and 2010. Clinical graduates of the programme from 1994 to 2009 were contacted anonymously via email by an experienced statistician to ask for details of their current position, scientific publications and career plans. They were invited to complete an online survey and questionnaire. No further communication took place until the analysis was completed.

Programme review

Applications, admissions and graduations

Applications to the programme have risen; applications from women rose rapidly in the first years and now constitute about one-third of enrolments (Table 1). Of 162 clinical undergraduates enrolled in the years 1989–2010, nine have left and 50 of

the remaining 153 are women. A total of 107 students (34 women) had obtained clinical qualifications by 2010; at the time of the study, 46 students were in the clinical or research phases.

Transfer from other universities

Of the 162 students enrolled to 2010, nearly one-quarter (n=36) transferred from other universities. Many clinical medical students studying in the UK from countries outside of the European Union apply, with 24 non-EU students enrolled from overseas.

Research topics

Students are encouraged to explore departments throughout the university and its affiliated institutes for their research projects. Whole-animal physiology, including neuropsychology, is the most popular and constitutes about one-quarter of the research projects; molecular oncology and neuroscience are also popular, together with immunology and transplantation sciences (Table 2). Apart from ‘wet-lab’ research, studies in intact animals and humans – including public health, radiology, pharmacology, brain repair and neuropsychology – are popular.

Academic achievements

Most (95%) students on the programme completed their research within 3.5 years. Two who had published research declined to submit a thesis. Most students publish their research findings in peer-reviewed journals of high international impact, and several have made discoveries that led to them being awarded national or international prizes for their achievements.

Of the 80 respondents, 47 had been awarded distinctions under the former (separate subjects) and current (integrated) final MB regulations. Most programme graduates have secured their preferred postgraduate training position and reported that their dual qualifications were an advantage at the competitive selection stage for clinical specialist training posts.

Less than 6% of students abandoned their research and left the programme: seven men and two women. Two (one woman) completed a Master of Philosophy (MPhil) degree before returning to clinical studies and one died unexpectedly during his final research year; they are not included in the overall analysis.

Postgraduate careers of MB/PhD alumni

Of the 31 MB/PhD programme students in academic positions who graduated by 2006 and had undertaken higher medical training in specialties, 17 were in tenured or tenure-track academic positions, including clinician/scientist or international travelling awards (n=6), clinical lectureships within the university hospital system (n=2) and scientific group leader positions (for example, in the Wellcome Cancer Research UK Institute for Developmental Biology and Cancer and in neuroscience within

Table 1. Programme status.

Type of student	Number of students
Graduates MB/PhD (1994–2010)	107
Women graduates	34
Current students	46
Women students	16
Total (1989–2010)	153

MB = Bachelor of Medicine; PhD = Doctor of Philosophy.

Table 2. Doctor of Philosophy research topics.

Topic	Proportion of total (%)
Animal/human physiology/ neuropsychology	25
Molecular oncology	20
Other neuroscience	15
Immunology (including transplant surgery)	15
Developmental biology	5
Molecular genetics	5
Infection	5
Biochemistry	3
Molecular endocrinology	2
Radiology	2
Cardiovascular	2
Epidemiology	1

the Department of Anatomy, University of Cambridge). Seven had higher training within specialties allied to surgery (neurosurgery, orthopaedic surgery, accident and emergency medicine, and otorhinolaryngology). One graduate has a tenured professorship and is departmental chairman of anaesthetics in a well-known medical school in the USA; another graduate holds a chair in psychiatry in the UK (appointed early 2011). Overall, 22 graduates were in academic group leadership positions. Of the 29 respondents who graduated in the five-year period 1994–9, more than half have clear plans for further academic development, including periods of full-time scientific research activity within clinical medicine. Other career destinations include major pharmaceutical companies (Table 3). One graduate works in bioinformatics, and one working in biomedical computing allied to pathology has enrolled on a Master of Business Administration (MBA) programme.

Discussion

Educational courses that offer clinical and research experience leading to MB and PhD degrees are unusual in Europe, and the Cambridge MB/PhD programme was an innovation in the UK. Our experience shows that engaging medical students' commitment to scientific research early in their careers encourages academic development and is associated with achievement of professional independence.

Students on the MB/PhD programme differ in their pattern of research activity from medical students who have undertaken conventional clinical training with the later option of applying for training fellowships after qualification. Most of our MB/PhD graduates continue academic work, and a majority gain further grant support for intermediate- and long-term fellowships – or faculty positions. Eighty (89%) alumni who had graduated with the MB/BChir degree in the period 1993–2008 provided full responses to the online questionnaire; of those, 31 were full-time academic staff and 90% explicitly expressed plans for further full-time research.

Graduates from the MB/PhD programme in the UK may differ from those in one survey in the USA,⁴ in which concern was expressed about the proportion of MD/PhD graduates not intending to pursue research as a primary professional activity (44%). An evaluation of MD/PhD alumni in the four years from 1986–1990 reported that only 25% applied for grants to the National Institutes of Health (NIH) and suggested that a minority become independent investigators.⁵ Whether proposed changes to the career structure, with a more integrated approach to the academic pathway, will improve these figures is uncertain. A comprehensive recent study of 5,969 current and former trainees in 24 programmes in the USA enrolling >40% of current trainees and representing half of the entire MD/PhD training funded by the NIH showed that most (81%) were employed in academia, research institutes or industry; 82% of those in academia were conducting research; and more than 60% had research funding.⁶

We acknowledge that not all graduates from the MB/PhD programme in the UK will take up clinical academic positions or

Table 3. Career pathways (Cambridge MB/PhD alumni).

Career pathway	Number of alumni
Clinical training (total)	35
FY1/2 posts	13
Specialty registrars	11
ACFs	6
Academic FY2	3
General practice	2
Industry/biotech	4
Senior directors	2
NHS consultants	9
Full-time academic staff	
University clinical lecturers	9
University senior lecturers	6
University readers	1
Assistant professors	2
Professors (chairmen)	2
Wellcome postdoctoral MB/PhD fellowships (ACF)	2
Clinician scientists	6
Senior research fellows	3
Total	80
ACF = academic clinical fellowship; FY = foundation year; MB = Bachelor of Medicine; PhD = Doctor of Philosophy.	

posts in university teaching hospitals but contend that the proportion actively pursuing their research interests is greater than would be expected of British clinical graduates. The careers of our MB/PhD graduates indicate that such programmes are one mechanism by which recruitment into academic medicine can be stimulated in the UK^{3,6–8} and that their introduction may address the widely held view that clinical science and academic medicine is in crisis.^{2,9–12} A few MB/PhD graduates in the UK are in senior positions in major pharmaceutical companies and thus are also positioned to contribute to the general development of translational scientific research, which is crucial to the development of medical therapies. Two graduates have become established group leaders and faculty members within the preclinical sciences community in Cambridge, enhancing links between the core and clinical biomedical sciences.

Our review of careers has revealed the involvement of MB/PhD graduates in procedural specialties (for example, cardiology) and specialties allied to surgery (anaesthetics, accident and emergency medicine, neurosurgery, otolaryngology and orthopaedic surgery). The respondents who have chosen such career paths have been convinced of the benefit of the PhD in securing competitive specialist registrar posts for higher medical/surgical training. To our knowledge there are no outcome studies of established programmes that offer an integrated period of full-time research training leading to the PhD integrated within clinical courses at universities in mainland Europe. In 1994, University College London established an MB/PhD programme, and other integrated masters or PhD programmes have been put in place in Newcastle, Leicester, Manchester and

Imperial College of Medicine, London. For many years in Sweden, about one-third of physicians completed a course of study leading to the award of degrees equivalent to the MD/PhD in the USA. These programmes are not integrated, but most participants conduct 'PhD' research over three years in their clinical specialty and directly after licensure to practice – a proportion make departures into basic science, most of whom return to clinical work but with a significant minority who never complete their clinical training. Until recently, a PhD equivalent qualification was considered advantageous for an academic career in major Swedish centres for those wishing to apply for consultant posts in district hospitals. Apparently this is no longer the case, but the MD/PhD equivalent qualification persists in Sweden.

The USA has extensive long-term experience of combined MD/PhD programmes within medical scientists training programmes (MSTPs): 32 such programmes take in about 250 new recruits annually across the country. The careers and professional activities of graduates of MSTPs funded by the NIH were reviewed in September 1998.¹ Those MD/PhD graduates who had enrolled on the formal MSTP were more likely to have received postdoctoral research training support and to hold academic faculty appointments. Members of this group were also more likely than others to have received research support from any source, and about three-quarters of those who applied were successful in obtaining later research support from the NIH. Combined graduates of the MSTP had greater numbers of publications overall and more publications during the most recent three-year period for which data were available. A study of the characteristics and career intentions of 1,833 recent participants in MD/PhD programmes and other MD programmes among 79,000 American medical graduates in a national questionnaire from 2000–6 showed that MD/PhD graduates tended to have greater planned career involvement in research and were more likely than graduates of other MD degree programmes to seek training in dermatology, neurology, ophthalmology, pathology, paediatrics and radiology.^{13,14} This latter finding accords broadly with our experience.

Our survey indicates many similarities with the experience of MD/PhD students; the North American initiative has been successful in achieving its aims, but recruitment into academic medicine in other developed countries seems to be insufficient to meet scientific aspirations. Unlike recent experiences in the USA,⁷ we have had burgeoning interest in the Cambridge MB/PhD programme and a stable proportion of women students.³ Many successful scientists and academic physicians clearly have had neither the opportunity for, nor the desire to participate in, integrated MB/PhD programmes – and investigators often pursue their field as a result of encounters within the practice of medicine with support from postgraduate clinical training fellowships from research councils or charities in the UK. Our programme does not preclude this pathway of career development but enhances opportunities for scientifically minded individuals at an earlier stage of professional development. The

postgraduate careers of the 80 students who qualified in medicine from the Cambridge programme indicate a strong commitment to academic work and higher medical training within the university hospital system.

Many graduates of the MB/PhD programme maintain contact with the director and remain secure in their decision to commit to this educational opportunity; more than 90% (73/80) of our respondents reported a beneficial effect on their careers – as well as a sense of creative fulfilment. Articles in the student medical press have stated that such opportunities should be an option at all medical schools in the UK.¹⁵ Our experience reinforces this view, and we contend that if all medical schools were to offer MB/PhD programmes for a proportion of their suitably qualified clinical undergraduates, medicine in the UK ultimately would benefit.

Acknowledgements

We are grateful for encouragement and burgeoning interest in the programme shown by the applicants, course members and alumni. Professor Tom Sherwood and Dr Christopher Allen provided key support. Dedicated administrative support and care have been provided by Jaysharee Ramsuran, Carol Reid, Lesley Flood, Susan Jay, Pam Daish, Karen Hinkins, Joan Grantham, Elizabeth Chatters, Val Hopkins and Helen Mason. Professors DT Fearon, JGP Sissons and J Herbert kindly helped with the selection process. We thank Professor Hans Wigzell (Karolinska Institute) and Dr R Gunnarsson for providing information about Swedish medical education. The Medical Research Council, Wellcome Trust and University Department of Pharmacology, as well as Trinity College, kindly provided initial studentship support. Latterly we have been indebted to Astra-Zeneca; Merck, Sharp and Dohme; Jean Shanks Foundation, *International Journal of Experimental Pathology*, Health Foundation, Gonville and Caius College (Comyns Berkeley and Elmore bequests), Parke-Davis and the Pinsent Darwin Fund. The Gates Foundation, Cambridge Overseas Trust and Cambridge Commonwealth Trust (director Mr Michael O'Sullivan, formerly Dr A Seal) also provide essential support for overseas members of the programme.

References

- 1 Glowinski I, Julian C, Onken J *et al.* *The careers and professional activities of graduates of the NIGMS medical scientist training program.* Bethesda, MD: National Institute of General Medical Sciences, 1998.
- 2 Horton R. The breeze of freedom. *Lancet* 2011;377:624.
- 3 Cox TM, Wakeford R. The MB/PhD programme. Training to be a clinician–scientist in the UK. *J R Coll Physicians Lond* 1993;27: 147–50.
- 4 Ahn J, Watt CD, Man LX *et al.* Educating future leaders of medical research: analysis of student opinions and goals from the MD-PhD SAGE (students' attitudes, goals, and education) survey. *Acad Med* 2007;82:633–45.
- 5 Whitcombe ME. The need to restructure MD-PhD training. *Acad Med* 2007;82:623–4.

- 6 Academy of Medical Sciences. *MB PhD programmes: a position paper by the Academy of Medical Sciences*. London: Academy of Medical Sciences, 2007. www.acmedsci.ac.uk/p99puid107.html [Accessed 5 October 2012].
- 7 Geulich JM, Singer BH, Castro MC, Rosenberg LE. A gender gap in the next generation of physician-scientists: medical student interest and participation in research. *J Invest Med* 2002;50:412–8.
- 8 Wyngaarden JB. The clinical investigator as an endangered species. *N Engl J Med* 1979;301:1254–9.
- 9 Oliver MF. The shrinking base of clinical science: where are tomorrow's researchers? *Eur J Clin Invest* 1977;7:1–2.
- 10 Academy of Medical Sciences. *Strengthening clinical research: report of the Academy of Medical Sciences*. London, Academy of Medical Sciences, 2003.
- 11 Bell J. Resuscitating clinical research in the United Kingdom. *BMJ* 2003;327:1041–3.
- 12 Thomas E. The future of clinical research – an outside-in view. *Clin Med* 2004;4:169–72.
- 13 Brass LF, Akabas MH, Burnley LD *et al*. Are MD-PhD programs meeting their goals? An analysis of career choices made by graduates of 24 MD-PhD programs. *Acad Med* 2010;85:692–701.
- 14 Andriole DA, Whelan AJ, Jeffe DB. Characteristics and career intentions of the emerging MD/PhD workforce. *JAMA* 2008;300:1165–73.
- 15 Brice J, Corrigan O. The changing landscape of medical education in the UK. *Med Teach* 2010;32:727–32.

**Address for correspondence: Prof TM Cox, Department of Medicine, University of Cambridge, Level 5, Addenbrooke's Hospital, Hills Road, Cambridge CB2 0QQ.
Email: tmc12@medschl.cam.ac.uk**

RCP books

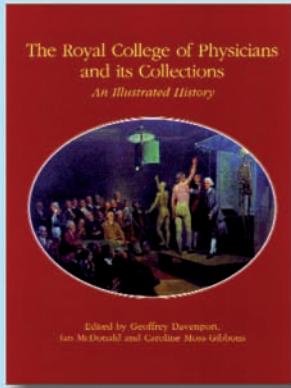
The Royal College of Physicians and its Collections

An illustrated history


Edited by Geoffrey Davenport, Ian McDonald and Caroline Moss-Gibbons

The Royal College of Physicians was founded in 1518, and its aim of 'providing the highest standards of medical practice in order to improve health and healthcare' is as true today as it was then. Written by fellows and historians, as well as drawing on Geoffrey Davenport's thirty years of service as librarian, the book describes the various means the RCP has adopted to achieve its aims, along with its successes and setbacks and the notable personalities involved. Covering nearly five centuries of history, this book is essential reading for anyone interested in the history of medicine and the Royal College of Physicians.

Published: May 2001 ISBN: 978 0 90938 383 3
Price: £38.00 UK, £45.00 overseas (inc post and packing)



Edited by Geoffrey Davenport,
Ian McDonald and Caroline Moss-Gibbons



**Royal College
of Physicians**

10% discount for fellows and members

Quote the reference *Clinical Medicine* when making your order