

# The combined medical/PhD degree: a global survey of physician-scientist training programmes

Author: Yassar Alamri<sup>A</sup>

ABSTRACT

Typically lasting 7–9 years, medical-scientist training programmes (MSTPs) allow students a unique opportunity to simultaneously intercalate medical (MBBS, MBChB or MD) and research (PhD) degrees. The nature of both degrees means that the combined programme is arduous, and selection is often restricted to a few highly motivated students. Despite the many successes of MSTPs, enthusiasm about MSTPs and the number of intercalating students, at least in some countries, appear to be diminishing. In this review, I shed light on MSTPs around the world, highlight the plethora of successes such programmes have had and provide insights on the setbacks experienced and solutions offered, with the aim of reigniting interest in these programmes.

**KEYWORDS:** Medical student, research, medical-scientist training programme

## INTRODUCTION

Medical-scientist training programmes (MSTPs) typically stretch over 7–9 years and allow students a unique opportunity to simultaneously intercalate medical (MBBS, MBChB or MD) and research (PhD) degrees. The nature of these degrees means that the combined programme is arduous, and selection is often restricted to a few highly motivated students.<sup>1</sup> Graduates of such programmes, clinician-scientists, often go on to obtain substantial research funds and take successful academic and leadership roles. The output of MSTP research has helped to advance medical sciences from the bench to the bedside<sup>1</sup> and maintain rigorously high academic standards in basic and clinical research.<sup>2</sup>

With the increasing competitiveness and rigidity of postgraduate clinical training programmes, taking significant time off to conduct research might be very difficult. Early exposure to research during medical school not only bypasses this obstacle, but also produces clinician-scientists who are

capable of bridging basic and clinical sciences and subsequently implementing this evidence base into their clinical practice.<sup>3</sup>

Despite the many successes of MSTPs, interest in these programmes<sup>4</sup> and the numbers of intercalating students,<sup>5</sup> at least in some countries, seem to be falling. In this review, I highlight MSTPs around the world to show their achievements and to provide insights on challenges faced and potential solutions. My aim is to reignite interest in MSTPs.

## North America

### USA

The North American MSTPs are significantly ahead of similar programmes elsewhere in the world. The Case Western Reserve University School of Medicine pioneered the combined MD/PhD programme in 1956.<sup>6</sup> In 1964, the US National Institutes of Health (NIH), under the leadership of Dr James Augustine Shannon, developed an MSTP to fund students interested in the combined degree.<sup>7</sup> Of the current 120 MSTPs, the NIH funds 45 programmes, whereas the other 75 are run independently.<sup>8</sup> The programme most commonly runs over eight years, during which students complete the first 2 years of medical school, engage in 4 years of full-time research and then return to complete the remaining 2 years of their medical degree (ie 2 + 4 + 2).

The bulk of the literature on MSTPs comes from US institutions. A large survey of US medical students (2000–06 graduates) showed that MD/PhD students have greater plans for future research-oriented careers than do MD students.<sup>1</sup> However, MD/PhD graduates with higher debts were found to deviate away from research-focused careers.<sup>9</sup> Of students who enrolled in an intercalated MD/PhD between 1995 and 2000, 73% had graduated with both degrees by mid-2011.<sup>10</sup>

The research focus of most US MD/PhD students has been basic and translational research,<sup>11</sup> the latter more often being translation of basic science findings into clinical interventions (T1 research) than translation of evidence-based medicine into clinical practice (T2 research).<sup>12</sup> This has been attributed, at least in part, to the fact that MD/PhD programme directors choose students whose attitudes and interests align with the goals of their programme.<sup>13</sup> Graduates of the intercalated degree were more likely to go into pathology, dermatology, ophthalmology, neurology, radiology and internal medicine residencies.<sup>1,14</sup>

Author: <sup>A</sup>MBChB PhD student, New Zealand Brain Research Institute and Department of Medicine, University of Otago, Christchurch, New Zealand.

Enthusiasm for the programme, however, appears to have lessened in the recent past. The reported attrition rates from MD/PhD programmes are between 10% and 28.5%.<sup>1,14</sup> Various reasons have been postulated, including the increasing debt burden<sup>15</sup> and the emphasis on T1 research.<sup>11</sup> However, these remain speculative because long-term and comprehensive data on outcomes of MSTPs remain an unmet need.<sup>3</sup>

## Canada

MD/PhD programmes offered by Canadian universities are not dissimilar to their US counterparts. Administered by the Canadian Institutes of Health Research (CIHR), the Canadian MSTP has been in place for upwards of 30 years,<sup>16</sup> training hundreds of Canadian clinician-scientists. The intercalated degree is run over a similar period and format to the US one, and students are heavily involved in basic and translational research.<sup>16</sup>

There are no published data to date on the outcomes of the Canadian MSTP.<sup>4</sup> Because of financial constraints, among other reasons, the CIHR announced in June 2015 that it would be ending the programme in 2016,<sup>4</sup> which has generated considerable controversy and an outcry from academic leaders to reconsider the decision.<sup>4,16</sup> Some Canadian universities, however, will continue to offer the combined degree even without financial support from the CIHR.<sup>17</sup>

## Europe

### UK

Combined MB/PhD programmes are unusual in Europe and were first introduced at the University of Cambridge in 1989.<sup>18</sup> The intercalated programme is designed in such a way that students are able to obtain both degrees in a total of 9 years, which includes 4 years of core clinical practice, 3 years of full-time research and, finally, 2 years of specialist clinical practice.<sup>19</sup> A voluntary questionnaire-based review of the programme output in 2012, more than 20 years since conception, identified 162 students. Only nine students (5.6%) had left the programme (one because of unexpected death).<sup>2</sup> Women made up almost a third (32.1%) of this cohort. Of the 31 students who had graduated by 2006, 17 (54.8%) were in tenured or tenure-track academic positions.<sup>2</sup>

Other universities in the UK soon followed the University of Cambridge's lead. In 1994, University College London (UCL) started its MB/PhD programme.<sup>20</sup> The programme structure is akin to that offered by Cambridge (ie 4 + 3 + 2). As of early 2012, 18 years after its conception, the programme had had 107 students (five of whom dropped out of the PhD component),<sup>20</sup> who had produced 622 peer-reviewed papers published in scholarly journals including *The Lancet*, *Nature Genetics*, the *New England Journal of Medicine* and *Proceedings of the National Academy of Sciences*.<sup>20</sup>

There has been a growing interest in the intercalated programme among UK medical students. In fact, an Academy of Medical Sciences' report encouraged medical educators to facilitate enrolment into MB/PhD programmes for keen students in an effort to combat the recent decline in clinician-researchers.<sup>21</sup> Currently, several British universities (Imperial College London, University of Manchester, Newcastle

University and University of Leicester) offer combined medical and research degrees.<sup>2</sup> Alternatively, interested British medical students have managed to self-organise a PhD degree in the midst of their medical degrees to circumvent the lack of such programmes at their universities.<sup>22</sup>

### Sweden

An MD/PhD programme is offered by some Swedish universities.<sup>23</sup> Furthermore, the Karolinska Institute has partnered with the NIH to allow US MSTP students the option of completing their PhD qualification in Sweden before returning to the USA to finish their MD degree.<sup>24</sup>

### Switzerland

Akin to North America, the MD/PhD programme in Switzerland is centrally overlooked by two organisational bodies: the Swiss National Science Foundation and the Swiss Academy of Medical Sciences.<sup>25</sup> The dual-degree programme was among the first in Europe (it began in 1992).<sup>25</sup> All Swiss universities with medical faculties participate in the MD/PhD programme. The Swiss programme is unique in that it offers two tracks to obtain the PhD: concurrently with a medical degree (track 1) or after completion of an MD degree (track 2). The current mean intake nationwide is between 13 and 15 students per year.<sup>25</sup>

About a quarter (24%) of all MD/PhD students select track 1. A minority of students (8%) quit the programme before completion. The outcomes of the Swiss MD/PhD programme have generally been very positive, with 98% of surveyed students having published one or more articles from their PhD research.<sup>25</sup>

## Asia

### Japan

In recent years, Japan has had an increasing demand for physician-scientists and clinical educators.<sup>26</sup> Two of Japan's universities have responded to this need by establishing MSTPs in their medical faculties. The University of Tokyo established its MSTP in 2008,<sup>27</sup> and the programme is modelled after American MSTPs. The MSTP at Fukushima Medical University was established in 2011.<sup>28</sup> Its MSTP is unique in that it runs over two phases: phase I runs in parallel with the MD degree curriculum and covers basic research science; phase II, completed after graduation, focuses on a research project and lasts 3 years.<sup>28</sup>

### Singapore

The National University of Singapore (NUS) inaugurated its MBBS/PhD programme in 2000. The combined degree spans 8 years (3 + 3 + 2), although it is possible to complete it in 7 years in special circumstances.<sup>29</sup> The NUS MBBS/PhD programme is competitive, with only three or four students selected every year.<sup>29</sup> Perhaps what distinguishes this programme is the generous support successful candidates receive, including tuition fee payments, stipends, overseas research opportunities and early exposure to potential career tracks (clinical, basic research and industry).<sup>29</sup>

## Australasia

### Australia

The combined MBBS/PhD programme at the University of Sydney was established in 1998.<sup>30</sup> Students took 2 or 3 years to undertake full-time research in the middle of their 4-year MBBS programme (2 medical + 2/3 research + 2 medical). In 2003, a group of 31 students of the combined programme were surveyed.<sup>30</sup> The sample was made up of eight women and 23 men, who had produced more than 30 articles in peer-reviewed journals, including *Nature*.<sup>30</sup>

That is not to say that the programme has not had its challenges, however.<sup>31</sup> In 2014, major curricular changes were adopted at the Sydney Medical School, and the previous combined MBBS/PhD programme was morphed into an MD and higher degree by research programme. The higher degree by research is often a Master's degree, but a PhD is still possible for the few who demonstrate their ability and keenness.<sup>31</sup> Other Australian universities<sup>32</sup> also offer an MBBS/PhD programme (or a variation thereof), although their outcomes have not been reported in the literature.

### New Zealand

The University of Otago offers a joint MBChB/PhD degree. Students complete 3 years of early learning in medicine, before embarking on 2 years of full-time research, after which they complete 3 years of advanced learning in medicine while completing and submitting their theses (3 + 2 + 3).<sup>33</sup> Data on the programme outcomes are generally lacking.

## Africa

### South Africa

In 2011, the University of Cape Town in South Africa introduced several intercalated degrees into its MBChB programme.<sup>34</sup> Medical students interested in undertaking a PhD apply for a series of upgrades from BSc (Med) to MSc (Med) and finally to PhD, which ensures close monitoring of the student's progress while not wasting their efforts if they decide not to proceed (ie they are awarded a degree for the work done). The first cohort of MBChB/PhD students is still in progress.<sup>34</sup> This young MSTP is yet to evaluate its outcomes, but is hoped to be a valuable catalyst for others in Africa.

## Alternatives, challenges and solutions

An alternative to the traditional MSTP, albeit uncommon, has been the PhD-to-MD programme. This programme offers established scientists the opportunity to undergo a fast-track medical degree (2–3 years, compared with the standard 4 years in the USA). In a retrospective study of 508 graduates of the University of Miami's PhD-to-MD programme (which was discontinued in 1989), 59% students were found to have taken academic positions at universities.<sup>35</sup> Moreover, these graduates of the accelerated programme were at no apparent disadvantage clinically. These findings led the authors to suggest shortening the traditional MD/PhD programmes in the USA.<sup>35</sup> Currently, Columbia University offers a similar programme in which established PhD scientists are offered an accelerated 3-year MD degree.<sup>36</sup>

Several challenges to the MSTP have been identified through reviewing pertinent published literature. Fortunately, most appear to be region-specific, and it is hoped that implementing strategies trialed by other programmes from other locales can help overcome them. These may include, for example, involving industry (Singapore) and private (Switzerland) sectors to help with funding cuts, broadening scopes of research (UK) to help combat high attrition rates, transnational MSTP collaboration (Sweden and US) and utilising data from long-standing programmes (US and Canada) to guide future directions of dual-degree programmes.

A few remaining challenges affect most combined programmes, and it is likely that root-cause analyses and creative solutions will be required. For example, women are consistently under-represented in dual-degree programmes.<sup>1,2,25</sup> Moreover, funding such programmes (especially the PhD component) remains problematic for both the intercalating student (ie increasing debt) and the institution (already on constrained budgets). These costs, however, are arguably significantly less than those associated with funding research fellowships after graduation. Finally, such programmes in developing countries are much less prevalent,<sup>37</sup> and help (material and intellectual) ought to be offered to propel research in these areas.

## Conclusion

The outcomes of the combined medical and PhD degrees have generally been very successful, although occasional setbacks are inevitable. Graduating clinician-scientists tend to continue their careers in an academic trajectory, and most pursue research at a level that is greater than would otherwise be expected of a medical graduate. Additionally, most alumni of such programmes are satisfied with their choices. Future research ought to focus on addressing factors that deter medical students from participating in similar programmes, widening the scope of research opportunities, counteracting the not insignificant attrition rates and obtaining medium-term and long-term data on the outcomes of combined programmes. ■

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**Address for correspondence: Dr Y Alamri, New Zealand Brain Research Institute, 66 Stewart Street, Christchurch 8011, New Zealand.**

**Email: [yassar.alamri@nzbrri.org](mailto:yassar.alamri@nzbrri.org)**