The Development of a Scientific Mindset for MD-PhD Students: Challenges and Strategies

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Irene Perini
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Contact: Madeleine Abrandt Dahlgren

The advances in biomedical research underscore the importance of synergy between scientific and clinical mindsets. The dual-degree MD-PhD program was launched in the United States (US) in 1964, with the intent to address the importance of integrating medical competence with scientific rigor. The MD-PhD is a unique program that allows to integrate clinical work with research, and it typically takes 7-9 years, and is restricted to students with high levels of motivation and dedication. Indeed, becoming a “physician-scientist” is a laborious path that comes with extreme dedication and the long-term commitment to medical research. Physician-scientists are well represented as Nobel laureates, and the impact and importance of this dual profile has been evidenced by the increase of novel therapies. This underscores the crucial ability of physician-scientists to bridge the translational gap and combine scientific innovation with critical clinical questions.

Nevertheless, a decline in the number of physician scientists has been evidenced for now decades. A student pondering whether to pursue a physician-scientist career must weigh in some clear obstacles, which include a long period of training, the uncertainty of success and insufficient financial reward. The latter can have a determining role in the US, where lower salary for those pursuing an academic career student are worsened by the already existing and staggering educational debt.

While higher level education is for free, in Sweden there has been a decline of 4% in MD-PhDs since 2015, a decrease that has been considered severe by the president of Läkareförbundet, Sofia Rydgren Stale, and others in a recent debate article. According to the authors, current medical education policies are not taking research seriously enough and the conditions for those students that want to pursue research are not financially sufficient. They suggest increased clarity in defining research-related responsibilities at regional level, greater investment in motivated students, provision of specialist salary after 5 years of specialization, to those that choose to combine clinical and research work. Finally, they suggest improving the conditions to ease the combination of research and clinical work at long-term, thorough the whole professional life. This could be achieved, according to the authors, by giving the opportunity to clinicians to do research during their “allmäntjänstgöring” and by giving research-specialization” forskar-specialiseringstjänstgöring” within all specialties. The highlighted obstacles in the opinion article, are only to some extent specific to the MD-PhD program. Indeed, the academic career poses challenges that are not unique to the MD-PhD program.
Statistics on sick leave are increasing in academics, due to increased stress-related diagnoses, with women strongly overrepresented. Finally, similarly to the MD-PhD program, young researchers often do not continue their pursuit of an academic career, because of the financial insecurity and the uncertainty that it poses to the future, compared to a career with the same profile in the industry.

This work will focus on some of the structural challenges of the MD-PhD model at Linköping University (LiU) that might contribute to the observed decline in physician-scientists, and strategies on how to allow students and supervisors to cope with them. There are some essential steps to guarantee the development of a scientific mindset: time, continuity, and exchange. The LiU MD-PhD model allows students to pursue their research education in parallel to their specialization (“specialiserinstjänsrgöring, ST-läkare utbildning”). The total duration of an MD-PhD program takes 8 years on average. During the research time, students must take classes for a total of 32 credits, and the remaining time can be dedicated to research. Students can perform their research for approximately 3-months per year, often spread in 4-week periods. Most European MD-PhD programs tend to have a different format, ranging from one to three years of full-time research. This is also observed in the US, where the MD-PhD program usually involves years of full-time research.

‘Life is short, the art long’ – Hippocrates

Full-time, long-term continuity is an essential feature of the development of a scientific mindset and the lack of it can undermine the motivation to pursue the physician-scientist career and the quality of the work. Experimental research projects in humans often require several months if not years of full-time commitment, as they are challenged by factors like slow recruitment, time-demanding planning, execution of data collection, and acquisition of statistical skills to perform data analysis. During the doctoral life, time is also often dedicated to daily activities that can feel pointless and frustrating, but that are crucial to cultivate the future scientist mindset. The daily challenge with elaborate literature, novel methods, and not always collaborative machines, provides an excellent training for problem-solving strategies and for the elaboration of novel research questions. The lack of long-term continuity is an issue in the current MD-PhD program at LiU that can challenge the acquisition of skills and cause delays in the performance of the projects, making research challenging and stressful for the MD-PhD student. How can we guarantee the development of a scientific mindset without full-time continuity? How can we provide realistic goals and a tangible structure to our MD-PhD students? Below are a few post-hoc insights for both students and supervisors, arising from years of supervision and open dialogue with my MD-PhD student, and considering existing guidelines and insights from the lives of Nobel laureates.

The scientific environment

The identification of a supportive and resourceful environment is crucial for a doctoral student and, in particular, for an MD-PhD student. To achieve excellence in research and especially when the ambition is to perform experimental studies, one must choose a research center that has a platform with adequate resources to face the lack of continuity of the MD-PhD candidate.
This includes staff that can help with recruitment, screening, and data collection. In addition, to practical research work, support is often needed in data analysis. Learning analytical methods can often require months of focus. By choosing the methods that are worth focusing on, and others that might be less relevant and can be performed by staff at the lab, the student can have more realistic goals.

**Prepare the student and prepare the staff**
The supervisor, together with the student and the lab staff, need to set some key staff roles. While projects and people are organic and plastic in nature, it is important, when feasible, to discuss and decide the role of the professionals involved in the planned studies and plan follow-up meetings where roles are discussed in relationship to the status of the project. Such professionals can include research nurses, PhD students and senior scientists. Given the lack of continuity, it is crucial that roles are well-defined, to guarantee a smooth project development, and when roles are suboptimal or obsolete, due to the length of the MD-PhD program, they should be redefined. This strategy can help the MD-PhD to feel included and supported, and the rest of the team to organize their priorities, workload, and motivation.12

**Integrate the clinical and scientific mindsets**
Coming from a clinical mindset, the MD-PhD student might start the journey with the expectations of time and resource efficiency typically forced by the clinical setting. Such features are extremely useful and important in research too, and the different mindsets and competences are precious in creating compatible roles and foster project efficiency. However, the timeline of research, and the constant practical and intellectual obstacles described earlier, can create feelings of frustration at early stages of the MD-PhD journey, which are worsened by the lack of continuity. It is therefore important to introduce and discuss through the whole doctoral journey some of the features that are typical of the research work and to provide the MD-PhD student with a supportive perspective on the individual achievements.

**Structure the timeline**
To allow for a motivating and successful doctoral project, a well-functioning timeline is essential.11, 12 The lack of continuity together with the long timeframe, make the MD-PhD project particularly vulnerable to delays in project and skill development, and can be prone to misunderstandings, mostly caused by insufficient room for real-life interactions. Therefore, a regular dialogue between supervisors and student and even between the student and other staff is necessary to avoid potential hindrances and misunderstandings. In addition, while the MD-PhD student is responsible for moving forward with the project, it is important to support her in characterizing both short- and long-term goals, to facilitate the structing of the work and identifying career strategies. Finally, and possibly most importantly, it is crucial to support the personal development of the MD-PhD student.11 This can be achieved by keeping a regular dialogue on the student’s identity to help the student visualize her development into a physician-scientist.

Physician-scientists are the main engine of translational research, and there is a sharp need of them. The lack of full-time, long-term continuity for research work in the current MD-PhD
program at LiU poses a challenge in building the scientific mindset in student aspiring to become physician-scientists. Therefore, a careful selection of the scientific environment where the research will be performed and structured and supportive supervision are central in aiding the students to fill the gap.

References