

O Médico-Cientista: A mesma Intensidade, na mesma Alma, para a Medicina e a Investigação

The Physician-Scientist: Same Intensity, in the same Soul, towards Medicine and Research

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When I was a kid, while watching a game with my father, the narrator commented on the lucrative contract that the star player of one of the teams had just signed. I remember that I excitedly remarked how lucky he was for being paid to play soccer and for making a living by doing what he enjoyed. Several decades later, what my father replied remains in my memory: "I also get paid for doing what I like! And if you are lucky enough, someday you will also be able to live and get paid for doing something you are passionate about". My father is an anesthesiologist and has treated patients in the same hospital for more than 35 years.

Unlike my father, I took a different path, one full of triumphs and defeats, of satisfaction, risk, and uncertainty. Although I am also a clinician (I am an internist), during the last 15 years, I have been devoted to translational investigation. Therefore, I am living an exciting but unsteady life as a researcher, a career chosen by only 1.5% of my professional peers.¹ In this editorial, I describe what it means to be a physician-scientist (PS) or clinical scientist, a professional model that has been at the forefront of multiple relevant biomedical advances with direct impact on clinical care, for example, the development of the smallpox vaccine, the discovery of penicillin and statins, the identification of anti-neutrophil cytoplasmic antibodies in systemic vasculitis, and more recently, the identification of the causative agent of the COVID-19 pandemic.^{2,3}

What is a PS? Classically, physician-scientists are physicians who diagnose and care for patients in the hospital setting and simultaneously perform clinical and laboratory research activities with the objective of understand the pathophysiology and thus improve the management of diverse diseases. By integrating the methodology of science with clinical practice and treatment intervention, physician-scientists have the unique opportunity to transfer scientific knowledge based on clinical needs directly from the laboratory to the patient (bench to bedside) and vice versa.⁴ The more contemporary definition of a PS not only includes areas such as physiology and therapeutics but also epidemiological research, genetics, public health, or computational medicine and the use of artificial intelligence, among others.

What are the advantages of being a PS? Throughout their career, physician-scientists can develop critical, curious, and creative thinking that allows them to distinguish what is clinically useful from what is merely interesting. They can approach clinical problems based on the rigorous discipline of the scientific method and then identify and prioritize the most relevant clinical conundrums. Physician-scientists are technically capable of performing laboratory experiments, conducting effective analysis of results, and disseminate scientific findings.^{5,6} Because of their dual professional experience (clinical and research), they are prepared to interact with both scientists and physicians, which allows them to work in hospitals, laboratories, academic institutions, government agencies, and the pharmaceutical industry (approximately 70% of scientific leaders of major pharmaceutical companies are physicians).^{5,6} Finally, I cannot omit the fact that working as a PS is intellectually stimulating and fun.

How can I become a PS? There is no single or exclusive pathway to becoming a clinical scientist. In fact, the mechanisms and levels of support for conducting training as a PS vary greatly from one country to another. In my opinion, formal research preparation achieved through the rigours and tribulations of a doctorate is the most effective (though also the longest) path to develop a career as a PS. In Europe, Germany and France offer educational programs that combine medical and doctoral training. In Germany, some universities offer a three-year PhD program, which often occurs between the second and sixth year of medical education. In France, students may opt for a 2-year research-focused master's degree before the fourth year of their medical training, which is then followed by a PhD that may occur before or during the specialty residency. In the United Kingdom, a small number of medical schools offer MD/PhD programs, with research activities usually developing after MD graduation.² Unfortunately, Italy, Spain, and Portugal have limited research training programs for medical students.^{2,6}

When it might be best to pursue a PhD, whether during or after medical school or residency, depends on multiple factors such as age of the candidate, availability of combined programs, financial support (scholarships), and

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medical specialty (research in clinical specialties is more common than in surgical careers). The number of years to formally obtain a MD/PhD degree can range from 8.5 years (in the case of joint MD/PhD programs) to 15 years (when the doctorate is completed after the specialty training).⁷

What are the difficulties of being a PS? Doing research is not easy. It is great, but as a PS you will face different types of adversities during your career. In the early trainee phase, limited exposure to science and laboratory activities, the absence of formal MD/PhD programs, and the lack of financial support are common obstacles that young physicians find for getting involved in research projects.⁶ During these early years, medical students often associate pure clinical careers with a more stable and lucrative future. In addition, the increasing complexity in clinical practice, coupled with the (monstrous) bureaucracy associated with patient care, results in limited time for reflection, intellectual development, or nourishment of curiosity, some of the major foundations of scientific thinking.

Regarding more mature physician-scientists, those with some years of experience in clinical and research settings, difficulties may include insufficient funding, lack of protected time for research, and difficulty in balancing personal life with work duties. This is usually a stressful phase where the transition and consolidation as an independent researcher is usually based on obtaining funding and salary support, which is associated with great professional and financial uncertainty. At this career stage, most physician-scientists are between 30 to 50 years, which coincides with the time of life when they are starting a family and have responsibilities in caring for children and elderly or ill parents.⁶ Unfortunately, it is not uncommon that during these years physician-scientists attempting to perform dual careers move into pure clinical activities, which is usually accompanied by better salaries. As for senior researchers, larger-scale funding is often a major issue. Research budgets are tight, and there is greater scrutiny of the return on research investment from public funders to society. At this stage, the leading investigator usually has a more administrative and leadership role, associated with responsibilities at the educational level, training of graduate students, and publication and dissemination of results. Finally, it should be noted that, regardless of age or years of experience, a PS usually confronts two common problems: the continuous and often inefficient curricular evaluation (e.g., quantity rather than quality of publications), and gender disparities.⁵

What are possible measures to promote investigation? The number of physician-scientists has markedly decreased over the last decade. This is in part due to insufficient funding, inconsistent institutional, private, and governmental support, increased clinical and teaching responsibilities, excessive administrative regulation, and the possibility of more lucrative positions in the private sector.^{6,8} Measures that

could favor not only an increased recruitment and retention of talented PS but also promote research activities in medicine may include^{2,5,6,9}:

1. To establish a “research culture” during medical school and medical residencies. Without early exposure, students are unlikely to have the motivation or confidence to participate in research activities. This must also include the development of structured research programs with shared contents.⁷
2. Increase financial support from hospitals, institutes, universities, and the private sector. Financing at all stages of the PS career is fundamental. Unfortunately, it is often thought that commitment to young researchers may represent a burden for institutions, as the initial investment seems to have limited immediate results. However, investment in science and research will bring more steady long-term benefits.
3. Establishing protected time for research projects. Hospitals must compensate and improve the balance of time and effort devoted to research. In this sense, the creation of 50%-50% contracts or periods of paid intensification for research activities are innovative initiatives.
4. Creation of PS societies aimed at creating academic and social support structures and providing technical and administrative support. These associations, in collaboration with universities and other scientific institutions, may promote recommendations or guidelines for the development of clinical research.⁶
5. Redefinition of curricular evaluation. The criteria for quality and productive academic and scientific production should be revised.
6. Promotion of diversity, equity, and inclusion, leading to greater representation of women and vulnerable groups in the medical-scientific workforce.
7. To develop mentoring programs. In my opinion, one of the fundamental aspects of research training is the possibility of having great mentors (I am grateful to all of mine!). Mentors with an established track record provide experience and knowledge that allows you to learn how to think and act as a PS and how to deal with the norms of academia. They also provide critical financial resources and access to technical resources and collaborative networks through their established research teams. Other strategies have been reviewed in recent publications.^{5,6}

To conclude, physicians who wish to become PS will need extensive institutional and family support, time, and dedication. We should provide them. Although in pure clinical medicine we have significant and important immediate gratification (e.g., by diagnosing and effectively treating for patients), the rewards of engaging in science are often less tangible and usually take longer to arrive.

However, the intellectual gratification of a research career, working with brilliant collaborators, the unique opportunity to participate in the creation of knowledge, and the creative freedom to solve important clinical problems are tremendously satisfying. Now, just as I was encouraged to do many years ago, I hope that all those who embark on this fantastic path will one day be able to make a living by doing research, by doing what they are passionate about. ■



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