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Editorial Article

Biomedical Researchers or Medical Doctors: Who Should Care About Their 'Fundamental' Differences?

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Abstract

Nowadays, medicine and research are two words virtually meaning the same thing for most people in the media or the general public - the loss of their original sense could have already led to significant impacts on health and innovation. Neuroscientists are good examples of biomedical researchers who fully appreciate the meaning of fundamental research. The object of their attention that is the system that controls our body - the brain, spinal cord, the peripheral and the autonomic systems - has become so infinitely complex that neurosciences went in just a few decades from one large field of research to hundreds of smaller sub specialized areas of expertise. The practice of medicine has also become increasingly complex and specialized - a medical doctor also called MD, physician, or simply doctor undertakes education and training that lead him or her to become either a generalist (family medicine) or as a specialist in emergency medicine, brain surgery, neurology, psychology, gastroenterology, or urology, to name a few. In all cases, these two very different classes of highly qualified professionals are expected to spend full-time work at discovering new biological mechanisms and therapies or at providing the best existing treatment to patients, respectively At different levels, fundamentally or clinically, they both work at improving the lives and quality of life of individuals with health problems. This said, a question remains - who should then receive research funds from private and public funding agencies if new innovative therapies are sought.

Editorial

MDs (Doctor in Medicine) are considered by many to be the "real doctors" because they can directly help patients with real day-to-day medical problems. PhDs (Doctor in Philosophy) remain unclear to the general public; although almost everyone knows that they conduct research and teach as professor. Except among colleagues, PhD doctors won't refer to themselves as doctor to avoid confusion. Yet, a key difference exists between the two degrees: PhDs advance knowledge, whereas MDs apply existing knowledge. With all due respect to both types of professionals, a parallel may be made with the car industry where engineers are trained to create new cars and mechanics to fix them. This lack of understanding among the general public probably begins with somehow confusing organizational names and structures within universities. Indeed, nowadays, most modern faculties of medicine across the world are organized as follows - there are different faculties (e.g., architecture, administration, etc.) but the large one associated with medicine and biomedical research is called the faculty of medicine. It is divided or composed of several smaller entities or departments such as the department of medicineper sefor the academic syllabus of new MDs only. There is also a plethora of teaching/research-oriented or purely research-oriented departments with B.Sc., M.Sc. and Ph.D. programs - e.g., in the former group, departments such as physiothery, ergotherapy, or kinesiology have been created for the education of corresponding health care professionals whereas, in the second group, there are departments such as anatomy, physiology, neurosciences, biochemistry or genetics which main mission is to train new professors-researchers. In other words, medicineper seis only for MDs whose job will be to clinically apply existing biomedical knowledge as treatment -

that is seeking the right diagnosis and identifying the corresponding treatment for each patient [1]. In clear contrast, biomedical research areas, associated with the other departments of the faculty of medicine, are composed of B.Sc., MSc and PhD degree holders whose main mission will be to conduct original fundamental and translational research for the discovery of new mechanisms and related-innovative drugs and therapies [2]. That is especially true for departments such as physiology, neurosciences, biochemistry and others of that kind with M.Sc. - and Ph.D. - only programs for graduate students and future fundamental researchers.

PhD's training and main job: In purely research-oriented departments such as in neurosciences departments, PhDs normally end up holding the title of professor (e.g., tenure-track position leading eventually to titular, full professor level). Their main task though is not to teach per se but to conduct full-time fundamental and translational research and to train graduate students in their own laboratory [3]. To achieve that, in most countries, they are expected to raise research funds (i.e., $0.1M - $1 M per year) from private and governmental agencies (e.g., NIH in US, CIHR in Canada and ERC in Europe) and to publish the result of their work in peer-reviewed, scientific specialized journals. Generally, someone holding a PhD degree (the highest diploma level in universities) from a biomedical department has had to successfully complete secondary school, college and first two university degrees that are the BSc (Bachelor of Science) and MSc (Master of Science) degrees. Although country-specific differences exist, this may represent all in all about 9 years of post-secondary education [4]. In addition, in most western countries, further specialized training as post-doctoral fellow ranging between 4 and 5 years (sometimes more) are mandatory for postulating as professor-researcher in biomedical research departments - a grand total ranging between 13 and 15years of post-secondary education are thus needed to become a full-time, laboratory director and principal investigator [5].

MD's training and main job: In contrast, to become a physician, academically, only the first university degree is required - the MD degree (first cycle as for the BSc degree). It lasts 6 or 7 years including the so-called pre-med school (another B.Sc. program prior to applying for MD program or equivalent) in North America (except in Quebec) [6]. Only half of the curriculum in spent learning basic fundamental notions such as gross anatomy, physiology or pharmacology whereas the second half is spent in the hospital with mentors (residents or fully licensed physicians) to learn about the day-to-day clinical work with patients in different areas such as internal medicine, psychiatry, or obstetrics [6,7]. From there, between 2 and 5 additional years are needed in general for specialization either in family medicine, emergency medicine, sport medicines, paediatrics, etc. One additional year is requested typically for areas such as neurosurgery or cardiac surgery. All in all, between 9 and 13 years of post-secondary education, pending upon the specialization, is done prior to obtain a full license as physician.,

Fundamental, translational or clinical research - Which does what? By definition, fundamental research comprises work with animals, biological tissues or cells that aims at understanding further specific biological or pathological mechanisms. Clinical research is essentially about studies performed with humans whereas translational research lies in-between with research designed to enable first clinical studies (e.g., toxicology and safety pharmacology in animals, tissues, and cells) [8,9]. Typically, fundamental researchers are best-trained to conduct the first two types of research that is fundamental and translational. Although, a small fraction of PhDs have specialized themselves in studies on humans (and vice versa for a small fraction of MDs that sought the dual MD/PhD degree), most clinical studies are done by MDs either in physician-sponsored or physician - initiated/industry sponsored-projects (i.e., only rarely do we find collaborative projects including both PhDs and MDs) [10,11]. Studies initiated primarily by MDs are constituted mainly of projects designed to obtain further data for evidence-based medicine or for drug repurposing or repositioning which is why the industry is often sponsoring them [12]. In clear contrast, fundamental researchers are trained specifically to identify new innovative drugs and therapies since that relies upon an in-depth understanding of complex biological mechanisms.

Funding research - who, when, where and for what. Perhaps because of this lack of understanding about the curriculum, training and expertise of MDs versus PhDs, there has been an increasing amount of funding from NIH, CIHR and other agencies made available to MDs rather than PhDs in recent years [13-15]. Consequently, this has driven more financial resources towards projects aimed at gaining data for evidence-based medicine and repurposing and repositioning old drugs. In fact, basic research funding in the US has decreased by 50% between 1997 and 2012 (approximately from 55% to 25% of available research funds) whereas pure clinical research has increased by two-fold during the same period (approximately from 8% up to 20% of available governmental research funds) [16]. That strategy drew money away from innovation and PhDs. The question then remains. What is the expectation of the population and tax payer in the first place? Given that money available for public research is not stretchable (i.e., depends on voted, fixed budget established by governments), do we want to continue using old drugs or, instead, discovering and developing new medicines for the many diseases still considered as unmet medical needs - i.e., with no significant available therapies. As a fundamental neuroscientist who ended-up because of a few clinically-relevant discoveries made in my laboratory to switch towards translational and clinical studies, I strongly believe (as others) that

research grants should be essentially if not exclusively distributed to fundamental researchers [13,16,17]. Physicians can often rely and will continue relying on private funding from the industry for conducting their physician-initiated studies [18]. However, who best to answer such a question than someone fighting a disease or a condition such as amyotrophic lateral sclerosis, multiple sclerosis, spinal cord injury, Parkinson's disease or Alzheimer's disease affecting still more than 8 million people in North America (http://www.ninds.nih.gov/).Having discussed with many patients suffering a spinal cord injury, I can confirm though that for most of them, fundamental research is the only hope that they still have to restore function and to walk again one day. Only clear and loud lobbying activities could possibly influence those voting budgets dedicated to research as well as directors of agencies receiving that money and deciding how it will be shared between basic and clinical studies those conducting them.

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