

Chapter 2

Is a Physician-Scientist Career Right for You?

*The first step to getting the things you want out of life is this:
decide what you want.*

–Ben Stein

Introduction

Early in your training, you will need to consider whether a physician-scientist career is right for you. To help you make this decision, this chapter examines the following questions: what is a physician-scientist? What types of research do physician-scientists conduct? How do you determine if you are suited for a career as a physician-scientist? And how do you become a physician-scientist? If you have already embarked on the physician-scientist pathway, I still encourage you to read this chapter. An important part of being a physician-scientist is to nurture the next generation. We train students in our laboratories, provide career advice to trainees, and serve as role models for the next generation. For these reasons, we need to articulate what a physician-scientist is, what we do, why it is important, and how aspiring physician-scientists can get started.

What Is a Physician-Scientist?

A physician-scientist is a practicing clinician who spends the bulk of his or her time doing research (Table 2.1). They usually work at academic medical centers. Like other academic physicians, physician-scientists are involved in teaching, administration, and clinical activities. However, physician-scientists are especially dedicated to generating new medical knowledge. Their role is important, because they identify novel and clinically relevant questions at the bedside and have the knowledge and tools to study these questions in the laboratory. They take their laboratory results and apply them back at the bedside.

Table 2.1 Physician-scientists versus clinician-educators

	Physician-scientists	Clinician-educators
Career	Spend the majority of their time in research and less in clinical work	Spend part of their time in clinical practice and part in teaching
Description	Investigate clinical questions that arise in practice to improve understanding and develop better treatments and practices	Implement new knowledge into practice and share it with students
Focus	Disease-oriented basic science research Application of basic science findings to patients Dissemination of research results Clinical investigation of patients Population and public health research Health services and systems research	Patient care Educational, evidence-based practice, dissemination methodologies
Place of practice	Academic medical centers	Academic medical centers
Education	Clinical training Additional research training Usually a Master’s or a PhD Two–three years post-doctoral research fellowship	Clinical training Possibly a Master’s May include specialization in educational theory/practice

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What Types of Biomedical Research Do Physician-Scientists Perform?

Biomedical research can be loosely divided into four subsets: (1) basic science research; (2) translational research; (3) clinical research; and (4) population research (Table 2.2). Physician-scientists balance their clinical activities with one or more of these areas of research. For example, I work as an interventional cardiologist. I spend 50% of my time on clinical activities like performing angiograms, angioplasties, and stress tests, rounding in the CCU, rounding on the cardiology consult service, as well as working one half-day in clinic every other week. I spend the other 50% of my time doing clinical and population research related to cardiology.

Basic Science Research

Basic science research is focused on developing a better understanding of both normal and abnormal functioning of the human body. It does not usually have a

Table 2.2 Types of research

Type	Description
Basic science	<ul style="list-style-type: none">• Increases knowledge and understanding of underlying disease processes• Does not involve human subjects• Examines molecular and cellular mechanisms of pathogenesis• Conducted in the laboratory
Translational	<ul style="list-style-type: none">• Translates scientific discoveries into practical, human applications• Requires mastery of basic sciences, technology, and laboratory techniques
Knowledge translation	<ul style="list-style-type: none">• Ensures that new treatments and research knowledge reach intended patients or populations and are implemented correctly• Implements strategies for improving the use of or adherence to treatment• Requires mastery of clinical epidemiology, evidence synthesis, communication theory, public policy, & mixed methods/qualitative research
Clinical	<ul style="list-style-type: none">• Applies basic science and translational research in patients• Tests new knowledge, treatments, devices, etc. in patients• Direct application to patient care• May lead back to the laboratory to refine treatments for human usage• Observational or interventional
Population	<ul style="list-style-type: none">• Studies human subjects to improve the health of populations• Identifies population-based risk factors and interventions to prevent onset of, interrupt the progression of, or improve population-based disease

1. Questions about Clinical Research. <http://www.niehs.nih.gov/research/clinical/join/questions/index.cfm#clinical>. Accessed March 25, 2009.

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6. Thomas C. Between bench and bedside – which research manuscripts are truly translational? Gastroenterology 2009; 136: 1484–1486.

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direct application to patients, but it provides the foundation that ultimately leads to improved understanding of the disease process and improved methodologies to prevent or modify it. Basic science research usually involves laboratory work far removed from patients. It can involve disciplines such as medical genetics and molecular biology.

Translational Research

Translational research spans the gap between basic science findings and actual clinical applications. It takes novel findings from the basic science laboratory and applies

them directly to the patient. Translational researchers use tools common to the basic science researcher, but they also conduct research involving patients. Recently, the term translational research has been subdivided into two types: T1 and T2. T1 translational research involves taking basic science findings and developing them into practical applications such as vaccines, pharmaceuticals, and diagnostic tests. T2 translational research is also known as knowledge translation research. This type of research disseminates results to pertinent stakeholders and seeks to translate results into practice.

Clinical Research

Clinical research involves human subjects but encompasses different types of study designs. Cross-sectional studies examine a group of patients who have a particular clinical syndrome or disease. Case-control studies compare patients with a particular outcome to patients without that outcome. Cohort studies follow patients with a particular exposure to an agent or event or belonging to a particular group and examine their clinical outcomes. Clinical trials randomize patients to one experimental treatment or versus placebo. Clinical research can also involve meta-analyses, where published studies are pooled together statistically to provide more robust estimates of the efficacy of a new treatment. Systematic reviews, where all the medical literature on a particular topic is reviewed in a systematic way so that conclusions can be drawn to influence practice, are also a type of clinical research.

Population Research

Population research is focused on improving the health of individuals and populations by studying questions that can only be answered by examining large numbers of patients. Population research often involves the use of large administrative databases to examine questions that cannot be investigated with smaller data sets. It also includes disease surveillance and population-level interventions. The results of these investigations are frequently used to guide healthcare policy at the institutional or government level. For example, the association between a recently released medication and a rare adverse event might be identified only in a large administrative database study.

Research and Clinical Activities

In addition to research, physician-scientists are involved in patient care, teaching, and administrative responsibilities. Individual physician-scientists vary widely with respect to how much of their time is available for research activities. Some physician-scientists spend almost all their time conducting research, while others spend 50% or less on research. Most individuals who spend less than 50% of their

time on research do not fit the classical definition of a physician-scientist. However, some senior physician-scientists have progressively taken on so many administrative activities that less than 50% of their time is devoted to research. If they are still productive researchers, I still consider them to be physician-scientists.

At the beginning of your career, it is often difficult to know how to apportion your time. Some physician-scientists who spend most of their time on research would be happier with greater exposure to patients. Conversely, some of those who spend much of their time on patient care would prefer to have more time for research. It is essential to establish a solid research program early in your career. For this reason, reserve the majority of your time for research. If you wish to spend more time on patient care once your research program is firmly established, you can easily move in that direction after a few years. It is difficult to move in the opposite direction. If only 20% of your time is protected for research early in your career, it will be difficult for you to establish a strong research program; without a strong research program, it will be difficult to convince your supervisor to provide you with additional protected time. Consequently, strive to devote 80% or more of your time to research when you begin your career as a physician-scientist. This percentage can easily be reduced later if you so desire.

What Is a Clinician-Educator?

Most physicians who practice in academic medical centers are not physician-scientists. In many institutions, these academic physicians are called clinician-educators (Table 2.1). The term clinician-educator indicates that the individual is both an excellent clinician and teacher. Clinician-educators spend most of their time seeing patients, teaching medical students, residents, and fellows, and performing administrative activities. The clinician-educator track has been developed at many academic medical centers to recognize the accomplishments and services provided by non-physician-scientists. At these centers, a separate set of promotional criteria have been established for clinician-educators. The traditional promotion track was skewed in favor of physician-scientists, and the chance of being promoted without substantial research accomplishments was limited. In the clinician-educator track, non-physician-scientists have a greater opportunity to advance academically based on their teaching, research, and administrative accomplishments.

At most academic medical centers, there is a large amount of clinical work to be done. If every academic physician were a physician-scientist, there would not be enough physicians to perform the clinical work. As a result, in most centers, the majority of physicians are clinician-educators. Clinician-educators do the bulk of the patient care, thereby protecting the time physician-scientists can devote to research. Although it is reasonable for an academic department head to expect that all members of his or her department be actively involved in some form of research, it is understood that the majority of the members of any department spend most of their time performing clinical activities.

Qualities and Skills Necessary to be a Physician-Scientist

You need to identify the type of career that will bring you the most satisfaction and allow you to make your greatest contribution to patients and society at large. If you think that a career as a physician-scientist will fulfill these needs, then determine at an early stage in your training whether you have the qualities necessary to be successful as a physician-scientist. You need to be intelligent, motivated, hard-working, and efficient. You also need to be a self-starter, an excellent problem solver, and an effective manager. You should enjoy being challenged by difficult problems, have a high tolerance for frustration and failure, be able to balance multiple projects at once, and be dedicated to and interested in the discovery and creation of new knowledge.

A physician-scientist requires an eclectic skill set. It is possible to be a successful physician-scientist even if you are weak in one or two of the skills required. However, if you lack skills in several domains, it is unlikely that you will be successful. For example, you need to be skilled at and enjoy biomedical writing. If you are not a good writer, it is possible to improve this particular skill. However, if you do not believe yourself capable of writing papers and grant protocols for the rest of your life, the physician-scientist career is probably not for you. Other skills you need to develop during your training are the following: the ability to identify compelling and fundable research questions; the perseverance to work on projects for months and years at a time; the ability to manage a research team; and the ability to collect and analyze data. If you cannot or do not want to develop these skills during your training, you might want to consider another career path.

Are You Suited for a Career as a Physician-Scientist?

Most physician-scientists identify their interest in research early in their medical careers, and many identify this interest while they are still medical students. Some begin by completing a combined MD–PhD degree program. Others get their first research experience during a medical school summer break or during a year off from medical school. Some perform their first research projects as residents or fellows. It is important to identify your interest in research as early as possible. The best way to identify whether you are suited for a career as a physician-scientist is to conduct a research project. Once exposed to the process of identifying a research problem, collecting and analyzing data, and writing a manuscript, you will be able to determine whether you enjoy the experience and whether you want to be involved in these activities as a significant part of your career. Only then can you move on to deciding how to obtain the necessary training.

Paths to a Physician-Scientist Career

Different people identify their interest in combining research and clinical practice at different stages of their training. There are multiple combinations of clinical and

research training that can prepare you for this career, but different training programs are more appropriate depending on when you identify your research interest.

Early Bloomers

Some students identify an interest in research prior to entering medical school. These students are often referred to as “early bloomers.” Their interest is frequently kindled during a research experience prior to or while attending university. For those who identify their commitment to research early on but who want to spend some time doing clinical work as well, the MD–PhD program is an excellent option.

MD–PhD Degree

The MD–PhD degree, a medical scientist training program established in both the United States and Canada, is excellent preparation for a career as a physician-scientist. Many universities in North America allow medical students to obtain a PhD during the course of their medical training (see Appendices 1 and 2 for a list of training programs). Typically, you go through the first two years of basic science training with the rest of the medical school class. Then, while the rest of your class goes on to the third and fourth years of medical school, you complete your PhD. The PhD requires three or more years. Once you have completed the PhD requirements, you return to do the third and fourth years of medical school.

MD–PhD programs were established to increase the number of physician-scientists. Most graduates go on to become physician-scientists, with the majority performing basic science or translational research. Very few graduates perform clinical or population research. The MD–PhD program has several benefits. First, if you are accepted into an MD–PhD program, your tuition to medical school is usually waived. Because of the high cost of medical school, this is a very attractive alternative. Second, the MD and PhD degrees are often completed in less time than it would take to complete an MD and PhD separately. Credit is often given toward the PhD for courses taken during the basic science years of the MD degree. Finally, the combination of the MD–PhD degree may allow you to integrate your clinical and research experiences in a way that sequential degrees would not.

The MD–PhD degree has several disadvantages, however. First, there is a significant time lapse between the second and third years of medical school while you work on your PhD. It can be difficult to re-enter the clinical world as a third-year medical student after such a long break. This can be difficult from a social perspective as well, since your cohort from the first two years of medical school has moved on without you. Second, your research area during your PhD may not correspond with your final career choice. It is often not until the third and fourth years of medical school, or even residency, that you identify which clinical area is of most interest to you. You may obtain a PhD in neuroscience, for example, but find after clinical exposure that you prefer obstetrics. Although some of the techniques obtained during your PhD may be useful in any field, it might be helpful to delay your research

training until you identify your particular area of clinical interest, so that you can get relevant specialized training in that area. Finally, after obtaining a PhD, most individuals complete the third and fourth years of medical school, residency, and subspecialty training. By the time you are an assistant professor ready to begin your research career, much time has passed since your laboratory training. By that time, your laboratory skills may be rusty, and it may be difficult for you to compete with pure PhDs who just completed their training. Consequently, many graduates of the MD–PhD program go on to do additional post-doctoral training before starting their first job.

Late Bloomers

Physician-scientists who do not obtain their research training in MD–PhD programs are sometimes referred to as “late bloomers.” Late bloomers are individuals who identify their research interests during medical school, residency, or subspecialty training. As opposed to individuals in the MD–PhD programs, late bloomers typically obtain their specialized research training sometime after medical school.

For an aspiring physician-scientist, it is preferable to become involved in research as soon as possible. This often means during medical school. Over the course of four years of medical school, a student can be exposed to research projects with several different supervisors. While medical schools provide an overview of the entire field of medicine, exposure to a particular research supervisor and one or more research projects can provide in-depth understanding of a particular field. Early research experiences are often the catalysts that help you develop a career as a physician-scientist. To facilitate this, most medical schools offer scholarships to students to conduct research during summer or winter breaks or part-time during the school year. Research supervisors often have ideas for multiple research projects but lack the time to complete them all. Medical students can provide the legwork required to advance many research projects, while discovering whether or not this career path appeals to them. With the help of a keen medical student, many successful research projects have been accomplished.

Some medical schools allow students to take a year off to do research. For example, I took a year off and went to Israel where I conducted research on magnesium deficiency and cardiac arrhythmias. As a result of this project, I ultimately became a cardiologist and a physician-scientist. My career start was not atypical. Many medical students have worked with me during their training. Many of them published articles in high-impact journals and developed a sophisticated understanding of a particular area that they never would have achieved without the focus of a research project. Most importantly, conducting a research project while a medical student provides you with significant insights into whether being a physician-scientist is an attractive career goal for you. At the beginning of medical school, most students have only a vague idea of what a physician-scientist is. During the course of their training, however, they come into contact with many physician-scientists. Although

medical students may decide to follow such a career path, they often do not know how to develop a similar type of career. Working closely with a physician-scientist helps them discover how to proceed along this career pathway.

If you have not performed research as a medical student, I encourage you to get involved as either a resident or a subspecialty fellow. During both residency and subspecialty training, there are elective periods when you will have the opportunity to be involved in research. These periods are excellent times to identify whether a physician-scientist career is a viable option for you. The more research projects you are involved in, the easier it will be to decide whether this career will suit you.

Very Late Bloomers

Very late bloomers are individuals who become physician-scientists late in their careers. Although unusual, very late bloomers do occur and are sometimes quite successful. These physician-scientists are often full-time clinicians or clinician-educators who practice medicine for many years and then decide to make a contribution to research. Virtually all of them take time off from their careers to go back to school to obtain an additional degree, such as an MSc in Epidemiology, an MPH, or even a PhD. I know a number of clinicians who followed this career path. Several of them have become extremely successful. The late bloomer pathway, although feasible, requires a lot of time, effort, and determination.

Additional Research Training

Virtually all physician-scientists obtain focused research training in addition to their clinical training. It is unusual to see a successful physician-scientist who has not spent at least one year doing focused research training. The more time you spend obtaining and honing the necessary research skills, the more likely you are to be successful. One mistake I frequently see among aspiring physician-scientists involves their choice of additional research/clinical training programs following their subspecialty training. They spend one or two years at another center obtaining a particular clinical skill. During that time, they write several papers. When they begin their first jobs as new assistant professors, they begin on the physician-scientist career track. However, several years later, their research careers flounder, because they have trouble obtaining grants and publishing papers. The reason for their failure is often that their research training did not, in fact, focus on how to become an independent researcher. Many clinical/research training programs offer opportunities to be involved in different facets of the research process, without teaching all of the skills involved or providing an opportunity to see a project through from start to finish.

Research training needs to provide you with the skills required to identify a viable, fundable research project, to design studies, to write solid grant proposals,

to collect and analyze data, to write manuscripts, to correspond with journals, and to publish papers. You also need to learn how to review manuscripts, review grants, and manage a research team. Many individuals who complete additional training after their fellowships are overly focused on learning a particular clinical skill. They may have the experience of writing an original research article based on data from a previously established database or the experience of writing a review article that is published in a high-impact journal. However, these experiences are not the same as obtaining focused research training that provides you with the skills you need to become a successful and independent physician-scientist.

Choosing Your Training

Decide whether you want to complete a formal research training degree program or an informal supervised experience with someone who is established in the field. In my opinion, it is better to obtain formal training. A Master's or PhD degree adds credibility to your research credentials and will help you obtain a position as a junior faculty member. When selecting an institution or a mentor, ensure that the experience can provide training in the specific skills your future career will require. In addition, consider the reputation of the program and the mentor within the academic community.

Master's Degrees

Many physician-scientists obtain an additional degree during their research training. If you are not prepared to spend the time necessary to obtain a PhD degree, there are several Master's degree programs that will give you the bare essentials needed for a career as a physician-scientist. Many physician-scientists who obtain Master's degrees go on to perform clinical or population research, while most physician-scientists who conduct basic science or translational research obtain PhDs. Perhaps the most common Master's degrees are the Master's of Public Health (MPH) and the Master's of Science in Epidemiology. There are also one-year programs with very specific foci, such as training in clinical trials or cost-effectiveness. These programs can be valuable to an aspiring physician-scientist.

MPH degrees can be obtained at many universities in North America and overseas, including Berkeley, Harvard, Johns Hopkins, North Carolina, Yale, and the London School of Hygiene and Tropical Medicine. Some MPH degrees are general in scope, like the one I completed at the Harvard School of Public Health. Others are focused on topics like epidemiology, biostatistics, or maternal and child health. At McGill, the MSc in Epidemiology degree has traditionally been a two-year program. The program can be thesis- or non-thesis-based. An MSc in Epidemiology gives you a solid base in the principles needed to perform clinical research.

Other Master's degrees can provide you with focused training in a particular discipline, but these degrees are not traditional routes for a career as a physician-scientist. These degrees include an MSc in Education, a Master's of Public Policy,

a Master's in Quality Assurance, and a Master's in Health Care Management. Although these degrees are not traditionally research-oriented, they do provide focused training in areas that are pertinent to medicine and that could potentially be used as a focus for a career as a physician-scientist.

PhD Degrees

Some physician-scientists complete a PhD after finishing their clinical training. My wife, for example, did a residency in internal medicine, followed by a Robert Wood Johnson fellowship in clinical epidemiology, and then a PhD in Epidemiology at Berkeley. She then returned to McGill, where she works as a physician-scientist combining cardiovascular health services research with a career as an academic internist.

When obtaining a PhD following your clinical training, the amount of time you dedicate to finishing the degree may be less than that required if it is completed prior to your MD degree. Typically, you need to be on campus only for course work. If you are organized and efficient, the research and thesis can be completed while you are working as an academic physician. This career track is an option if you want to become a basic scientist with only a small amount of your time dedicated to clinical practice. Whereas obtaining a PhD as part of an MD–PhD program involves years of clinical training during residency and fellowship before you return to the laboratory, obtaining a PhD after your clinical training allows you to hit the ground running. When you begin work as a new assistant professor, you are in command of the latest laboratory techniques. Whether you complete a PhD following your clinical training or as part of an MD–PhD program, you may ultimately need to do a post-doctoral fellowship to be competitive with pure PhD biomedical scientists.

Timeline for Training Programs

Most individuals obtain their focused research training after residency. You should examine potential training programs at least one year before you wish to begin your training, and you should explore training awards at least nine months before. However, each institution and funding agency has its own timelines, so the earlier you look into them, the better will be your chances. More detailed information about choosing and applying for a training program is presented in the next chapter.

After Training

Your career as a physician-scientist really begins when you start your first job and receive an appointment as an assistant professor. Most new assistant professors obtain similar agreements when they start their careers as physician-scientists. Your time is usually protected for research for a period of three–five years. During that

period, you need to obtain an operating grant and generate solid publications. In some institutions, you will need to obtain a career award as well. At the end of this period, if you are unsuccessful, you will likely be obliged to switch to the clinician-educator track. Therefore, if you want to be a physician-scientist, it is important to get a good start. Develop the skills required before you become an assistant professor. You need to have excellent clinical training as a medical student, resident, and subspecialty fellow. In addition, you will require at least one and preferably many years of additional research training. The more years of focused research training you obtain, the more likely you will be to succeed. Although there are many career trajectories that will enable you to become a successful physician-scientist, they all follow the same common pathway: obtaining a combination of excellent clinical and excellent research training.

Summary

Whether you are contemplating a career as a physician-scientist or are already a physician-scientist and are mentoring trainees, it is important to have a clear picture of what this career entails and how to move it forward. Every physician-scientist has a unique story about how they arrived at where they are. There are no right or wrong paths. The key is to obtain excellent clinical and research training and to have the desire to include medical research as an important component of your career.

Key Points

- A physician-scientist is a practicing clinician who spends substantial time doing biomedical research.
- Physician-scientists are also involved in patient care, administration, and teaching.
- A clinician-educator is a practicing clinician and teacher who does not spend substantial time doing research.
- There are four main areas of biomedical research: basic science, translational, clinical, and population-based.
- Most physician-scientists spend $\geq 50\%$ of their time on research.
- Get started in research as soon as possible by participating in projects during medical school, residency, and fellowship.
- Obtain as much focused research training as possible.
- Learn to identify fundable research questions, write research proposals and articles, collect and analyze data, and manage multiple projects at the same time.
- New assistant professors typically receive three–five years of protected time for research, during which they need to obtain an operating grant, generate publications, and optimally obtain a career award.

Suggested Reading

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