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Forging an Early Career in Cardiovascular Investigation

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We live in a tremendously exciting time in cardiovascular medicine. Cardiovascular mortality has declined in the United States by more than two-thirds since the 1960s, thanks to widespread improvements in heart disease prevention (eg, reduction in cigarette smoking, widespread use of statins and antihypertensive medications) and treatment (eg, percutaneous coronary intervention, transcatheter valve intervention).[1] Our therapeutic arsenal now includes gene-based therapies, and gene editing to prevent and treat heart disease is on the horizon. At the same time, favorable trends in cardiovascular mortality have stalled overall and even reversed in subsets of the population, with marked persistent racial/ethnic and socioeconomic disparities in outcomes.[2,3] Moreover, the fundamental pathobiology of many cardiovascular conditions (eg, heart failure with preserved ejection fraction, coronary microvascular dysfunction) remains incompletely understood, and treatments for these conditions remain limited. This landscape highlights important challenges but also key opportunities for the next generation of cardiologists to advance the prevention and treatment of heart disease.

Many of us enter the field of cardiology hoping to combine clinical care for individuals with complementary activities to improve clinical practice and public health more broadly. Combining clinical care with research represents a highly rewarding path for the person who loves asking and answering questions. This path can take many forms (basic science, translational science, clinical investigation, outcomes research, implementation science, and so on). However, the researcher's path may also seem daunting, highly nonlinear, and fraught with uncertainty and added challenges; being equipped and supported to tackle these challenges is critical for sustainable success and satisfaction as a cardiologist-investigator.

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My own story represents a nonlinear journey to becoming a physician-scientist and highlights some of the key ingredients needed to launch a research career—most importantly, having supportive, engaged mentors. I studied public policy as an undergraduate. I then became fascinated by pregnancy physiology in medical school and had planned to become an obstetrician until a fourth-year medical school rotation in cardiology ignited a passion for clinical cardiology and prompted a last-minute change of plans. As a new cardiology fellow, I knew I was passionate about women's heart health but was uncertain whether or how research might fit into my career. Then, early in followship, I spent a day working clinically with Dr Pradeep Natarajan, an expert in cardiovascular genetics; this interaction ultimately led me to pursue dedicated training in cardiovascular epidemiology and genetics under his mentorship. Although I had no prior experience in computational research or genetics, Dr Natarajan proved to be an outstanding mentor and sponsor whose support and guidance catalyzed early research success and transformed my career.

Today, I work as a general/preventive cardiologist-scientist who uses genetics, multi-omics, and other approaches to glean new mechanistic insights into sex-specific cardiovascular risk factors in women[4] and other emerging risk factors. Although I am still very early in my career, I believe my experiences may be helpful for trainees and faculty contemplating or planning a career in research. To that end, I propose "10 tips" for forging an early career in cardiovascular investigation.

1. *Build a mentorship team*. Mentorship and sponsorship are critical at every career stage. Mentors should be invested in your career development and should ensure you are making progress toward goals (eg, publications, grants, hiring, promotion, leadership). Many core scientific skills, such as effective grant-writing, are taught primarily by mentors. Although it is conventional and indeed helpful to identify a primary mentor, no single individual can know everything about every aspect of academic medicine, and I have found it helpful to cultivate a mentorship team—one that spans different career stages, different medical and scientific disciplines and expertise (eg, clinicians and researchers in adjacent areas of investigation and complementary methods), and different aspects of professional life. Importantly, mentorship is a "2-way street," and you can help your mentors to be maximally helpful to you by staying organized, circulating an agenda for meetings, sending reminders, and following through on deliverables in a timely fashion. If executed well, a mentor-mentee relationship can be a rewarding, symbiotic relationship of bidirectional learning and synergistic productivity.

2. *Obtain dedicated research training*. Research requires a distinct skillset from clinical care, and dedicated instruction in research methods enables investigators to effectively formulate scientific questions and develop testable hypotheses. This training does not necessarily need to take the form of an advanced degree, but true investment in this skillset is essential. Across research types and methods, a strong foundation of basic statistical analysis will serve you well to understand how to appropriately capture, visualize, analyze, and interpret data.

While it is never too late to learn new methods, solidifying these analytic skills while in training will pay dividends in enabling more rapid, seamless acquisition of new skills down the road.

3. *Protect time for deep thought and deep work*. The freedom to think deeply about complex problems is crucial for meaningful scientific discovery. It is no secret that protected time for deep thought and deep work is frequently under threat in present-day academic medicine. Schedule uninterrupted blocks of time in your week for reading, writing, and planning. Relegating "research time" entirely to nights and weekends will hold your science back.

4. *Learn to write well*. Clear, compelling written communication is an indispensable and oftoverlooked scientific skill. You need to communicate the importance and implications of your work to journal editors, reviewers, funding agencies, and colleagues. In addition, high specificity of language is required to accurately convey methods and findings. Your writing should be compelling and persuasive. Nit-pick the details. Write, and then rewrite to improve clarity.

5. *Complete the project*. Seeing research projects through to completion is important for your own scientific growth and to cultivate a track-record of research output, which is of great interest to employers and funders. However, research frequently does not come with the same built-in timelines and deadlines as other part of your career, such as clinical care. Creating your own benchmarks can help ensure the research continues to move forward. For example, in training, I was taught to use scientific meetings as deadlines for manuscript submissions: Submit abstracts to meetings once you can formulate a complete, accurate abstract, then ensure that the full manuscript is submitted to a journal no later than the date of the meeting. This system ensures that each project is moving forward. In addition, take pride in your work. It is possible that not every project will align perfectly with your passions and interests, especially in training, but the learning acquired through the scientific and publication process will be highly transferable to other future endeavors. Navigating the publication process represents its own important skillset.

6. *Be persistent*. Related to the aforementioned point, rejection and disappointment are part of science. Both manuscript review and grant review can be capricious, and everyone has grants and papers rejected. The key is to learn as much as possible from rejections, iterate, and try again. As a mentor once told me, "You get to spend one night feeling bummed out about the rejection, and then tomorrow, you revise and submit again."

7. *Seek out opportunities to provide peer review*. Participating in the manuscript peer review process helps you to better understand the publication process and helps you think more critically about your own work. Your mentor can help identify peer review opportunities.

8. *Cultivate curiosity*. Questioning why we observe certain clinical phenomena or employ certain diagnostic or therapeutic strategies reveals new avenues for

investigation. Where do the guidelines have a high level of recommendation but low level of supporting evidence? Where are the key gaps in our understanding of disease, and how does this impact patient care? As a clinician, every time you explain to a patient that we don't know why some people get a particular disease, how best to treat it, or how/why certain treatments work, you are identifying knowledge gaps. Another strategy to foster productive curiosity is to read beyond your comfort zone—into the underlying methods, into more "fundamental" levels of science than your area of investigation (eg, for clinical/translational scientists, into basic/bench science), and into adjacent and related fields beyond cardiology (eg, in my case, genomics, hematology, endocrinology, and obstetrics). Reading broadly helps to cultivate interdisciplinary thinking and forge collaborations across disciplines (more on this below).

9. *Collaborate*. Research is a team sport, and bringing together different datasets, data types, and complementary expertise frequently elevates the quality, impact, and reach of a scientific manuscript. Be sure to clearly outline contributions and authorship expectations at the outset when pursuing collaborative projects.

10. *Know yourself*. What do you love to do? What brings you joy? What invigorates you? Ongoing active reflection and self-examination is important as you dive into a research-focused career.[5] A career in academic medicine is a marathon, not a sprint. There is great need and ample opportunity to make an impact, but successes will be punctuated by challenges and struggles, so it is important to keep big-picture goals in mind. Pursue research that aligns with genuine passions, and don't be afraid to venture into areas of investigation that have been historically neglected by the cardiovascular field (eg, implementation science); these areas may afford some of the greatest opportunities to make an impact. Protect time for family, friends, and hobbies to maintain balance and overall well-being. Most importantly, have fun—we are fortunate to have one of the most exhilarating, rewarding jobs in the world.

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