

EDITOR'S PAGE

# Training the Next Generation of Translational Cardiovascular Investigators



## Is the Pipeline Half Full or Half Empty?

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One of the major goals of *JACC: Basic to Translational Science* is to provide an open forum for discussions by translational cardiovascular investigators in academia and industry; patients and families affected by heart disease; the National Heart, Blood, and Lung Institute (NHLBI); and the U.S. Food and Drug Administration (1). An important component of this vision is to support the training and career development of the next generation of cardiovascular translational scientists by promoting discourse among the key stakeholders. For many translational investigators, who learned how to translate novel concepts from the bench to the bedside before formal translational training programs existed, training consisted of on-the-job acquisition of a variety of skillsets, generally acquired from experts in various fields who were scattered all over the globe. Although this was possible when the nascent field of translational science was still emerging and the requisite knowledge base was comparatively smaller than it is today, this type of training is impractical today in the era of “big team science,” which requires collaborative interactions between basic and clinical investigators in academia and industry, as well as with governmental, funding, and regulatory agencies. As we noted in the inaugural issue of *JACC: Basic to Translational Science*, it is not possible today for 1 person to acquire all of the requisite skills needed to conduct all aspects of translational research (1). This means that the next generation of translational

investigators will have to learn how to integrate and collaborate with large scientific teams to move their ideas forward. Recognizing this, the question then arises of how to best train young investigators to have successful careers in cardiovascular translational science. More importantly, how do we convince young people that a career in translational investigation is not only rewarding and exciting (which it certainly is), but also doable as a short-, intermediate-, and long-term avocation? Here, we share several thoughts and raise questions that we believe will be important to move the field forward.

Any discussion of how to train people to undertake translational investigations and conduct translational research needs to begin with an operational definition of translational research, which in and of itself could occupy several issues of this or any other journal. Here, we have used the working definition proposed by the Evaluation Committee of the Association for Clinical Research Training as a starting point: “Translational research fosters the multidirectional integration of basic research, patient-oriented research, and population-based research, with the long-term aim of improving the health of the public” (2). Importantly, the Association for Clinical Research Training definition incorporates 2 of the major themes articulated in prior definitions of translational research provided by the National Institutes of Health (3) and the Institute of Medicine (4). First, translational science requires collaborative interactions among investigators in multiple different scientific disciplines. Second, translational science is inherently bidirectional (bench to bedside and bedside to bench). Given these broad themes, it is clear that there are, in principle, many possible approaches that could be taken in the training of the next generation of translational scientists that could provide a viable

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path to achieve successful outcomes. With that said, it seems equally clear that “one size will not fit all” and that the pathways for training translational investigators will require considerable emphasis on individualizing the education and training of each investigator.

To obtain provisional information about the current organized institutional efforts to develop and implement cardiovascular translation research training programs, we queried the Division of Cardiovascular Sciences (DCVS) of the NHLBI and asked how many of the currently funded T32 training programs had a translational focus. Of the 124 active T32 grants administered in 2015 to 2016, 7 (6%) had “translational” in the program title and proposed training of post-doctoral fellows in translational research. From the T32 awards with translational in the project abstracts, there were an additional 7 (6%) with strong translational components. Moreover, there were 53 more programs (43%) that referred to translational medicine and/or to translational research centers. Overall then, the majority (54%) of the DCVS-sponsored T32 training programs provide some opportunity for exposure to and/or training in translational research. The approaches used to provide this exposure, however, vary greatly, from having faculty mentors who are engaged in translational research to associating the program formally or informally with centers for translational medicine. Importantly, however, only 6% to 12% of the DCVS-sponsored T32 training programs featured strong translational research training components as the cornerstone of their programs. Another vehicle for training cardiovascular translational investigators is through the National Institutes of Health-sponsored Clinical Translational Science Awards program, which has provided important infrastructure to improve the quality of training in clinical and translational research. Unfortunately, the critical insight that is missing from the previously mentioned provisional analysis is the lack of a precise understanding of the core competencies within each of these programs that enables trainees to have successful careers in translational medicine.

### **TRAINING THE NEXT GENERATION OF TRANSLATIONAL CARDIOVASCULAR INVESTIGATORS: IS THE PIPELINE HALF FULL OR HALF EMPTY?**

Although a Medline search indicates that the term “translational research” appeared as early as 1993, it

was not until 2003 that the term began to appear consistently in the published cardiovascular data. As noted in the previous text, the half-full aspect of the question is that >50% of the current DCVS NHLBI T32 programs have indicated that there is a translational training component in their programs. This type of focus did not exist 15 years ago. Unfortunately, the half-empty aspect of this important question is that, unlike training programs in basic and clinical sciences, where we have a somewhat better grasp on how to train investigators to be successful, we currently lack the information, experience, and important outcomes data needed to develop the core competencies and elements of training that are required for successfully developing cardiovascular translation scientists. Our own view is that translational training programs must be broad enough to offer trainees exposure to the full spectrum of translational investigation, including bench, clinical, community-based, prevention, and cost-effectiveness research, so that trainees have the opportunity to learn how to interact effectively with teams of scientists who have varied backgrounds. However, translational training programs must also provide each and every trainee with specific skillsets that will allow them to become integral and vital members of scientific teams. We acknowledge that because we are early in this process, it seems likely that the approaches to training will vary and will need to be modified over time as we “learn” what does and does not work. This means that training programs will have to be not only integrated and interactive, but also adaptable.

In addition, it seems very clear that the metrics for evaluating contributions and for measuring the success of translational scientists will need to be different from those used traditionally in evaluating basic and clinical scientists because of the collaborative team science approach that is required for translational research. This, in turn, will require that academic institutions learn how to recalibrate their tenure and/or promotion criteria to encourage investigators to pursue translational careers, which is an entirely different discussion (and a likely topic for a future Editor's Page). As always, we welcome your thoughts, and would ask you to share your opinions on the issues we have raised with respect to training the next generation of cardiovascular scientists either through social media ([#JACCBTS](#)) or by e-mail ([jaccbts@acc.org](mailto:jaccbts@acc.org)).

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