What Should We Learn From the Recent Decline of Basic Cardiovascular Science in Japan?

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In this issue of Circulation Research, Shimokawa et al report that the number of scientific publications submitted from Japan to the American Heart Association journals recently has dropped impressively compared with just 17 years ago (from 164 papers in 2000 down to only 45 in 2016), when Japan published more papers than any other country except for the United States and Germany. Although the recent decline in the number of Japanese papers published in many, if not all, areas of science has been reported repeatedly, the report by Shimokawa et al struck us as particularly noteworthy because the decline in the field of basic cardiovascular sciences seems more prominent than that in some other areas of basic science in Japan. The authors of this Editorial think that probing the causes of this dramatic decline and discussing what can be done to halt the slump are useful for the cardiovascular basic science community worldwide, because many developed countries share at least some of the causes of the decline we have witnessed recently in Japan.

Why Is It Happening?

The focus of research and its methodology have changed dramatically during the past 2 decades. Compared with the more descriptive papers published in the 1990s, recent publications published in the American Heart Association journals include more mechanistic investigations, often with more complex studies using multidisciplinary approaches requiring collaborations with investigators across the field. One can argue that the recent slump in Japan may be caused simply by the fact that the area of research and its methodology has shifted away from those on which Japanese scientists are focused.

Another contributing factor may be the status of the Japanese economy. The long-lasting economic slump since the early 1990s and increased spending on social security, because of the rapidly growing population aged >65 years, and for the recovery from the Tohoku/Fukushima catastrophes have been squeezing the budget for research and education. Accordingly, the Japanese government is no longer as generous with money for research as it once was.

However, Shimokawa et al think that there may be more fundamental reasons for the decline, and we agree. In 2004, because of a change in government policy, public universities in Japan were forced to become financially independent. In return, a support from the government to each university has been reduced substantially. Since then, more money has been shifted toward clinical management rather than research. Because cardiology is a leading source of income at many medical schools, cardiologists are asked to spend more time in practice rather than research. The time commitment required for clinical work and other duties precludes many MD scientists from handling the lengthy experiments required for publication in high-profile journals. Historically, and perhaps uniquely in Japan, MDs have been the driving force of basic cardiovascular science, because, until a decade ago, many young MDs routinely engaged in basic research as part of their training programs. This is in contrast to cancer research, where more PhDs are involved. Thus, the increased demands on physicians’ time have directly affected basic cardiovascular science in Japan.

The situation in the field of cardiovascular medicine is gloomy. Unfortunately, the proportion of research funding directed to cardiovascular medicine is far less than that for cancer and other fields (Figure 1), and its ratio continues to decrease, despite the fact that cardiovascular disease and stroke remain the leading causes of death and hospitalization among the elderly in Japan. Although the lack of correspondence between funding and the serious needs of the population is surprising, it might be partially because of a lack of public awareness of the importance of cardiovascular research compared with other diseases. We hear touching stories of cancer survivors more often than those of survivors of cardiac arrest or heart failure. In addition, it may be related to the fact that cardiovascular diseases are not currently the highest priority for major pharmaceutical companies in Japan. To put it simply, money seems to follow money. In fact, the number of Japanese publications in the field of cancer research has grown steadily at an annual rate of 4.5% since 2005.

With the aging of its population, the number of MDs in Japan actively seeing patients is also decreasing. Currently, the number of MDs per 1000 people in Japan (2.3 in 2012) is among the lowest in the Organization for Economic Cooperation and Development member nations. This forces many active MDs to spend more time on patient care than on research. Many young MDs focus on acquiring clinical skills right from the start of their careers, which often permanently deprives them of the opportunity to conduct basic science.

The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.

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(Circ Res. 2017;121:314-316. DOI: 10.1161/CIRCRESAHA.117.311411.) © 2017 American Heart Association, Inc.

Circulation Research is available at http://circres.ahajournals.org DOI: 10.1161/CIRCRESAHA.117.311411
This problem is even more serious in academia, where the number of young faculty <35 years of age, the driving force of research, has decreased >30% since 1980.5 Unfortunately, the Japanese government spends less on higher education than other Organization for Economic Cooperation and Development member nations (second from the bottom) and the system to raise independent scientists, such as through tenure track positions, is still immature. In 2010, among 1350 new PhDs in natural science, only 746 obtained full-time positions.6 This job insecurity deters young Japanese from entering PhD programs, and the number of PhD students has been steadily decreasing in Japan since 2005. These issues are more serious than the others discussed above, because they affect science in the next generation and, thus, could have more long-lasting repercussions.

What Needs to Be Done?

What can Japanese cardiovascular scientists do? First, more time should be invested in informing the public about the importance of cardiovascular research. A new 5-year plan developed by the Japanese Circulation Society to prevent cerebro-cardiovascular disease and extend healthspan7 may serve as a reference point. The Japanese Circulation Society will direct the registry of cerebro-cardiovascular disease cases at participating hospitals and publicize accurate evidence demonstrating that multiple efforts to combat cerebro-cardiovascular disease decrease mortality and extend healthspan in cerebro-cardiovascular disease patients. Although this approach appears a long way around, it would certainly strengthen public awareness and eventually convince the government and other sources to allocate more funding.

Second is to secure the funding to raise young scientists. Alongside the current mechanism of funding from government agencies that preferentially funds areas that provide immediate returns, parallel mechanisms to distribute research funding to local universities and young scientists should be enhanced. If this is not immediately possible, this should be considered at the local university level, and the effort to increase funding from previously unexplored sources, including philanthropy, should be enhanced. This would support creation of more tenure track positions and increase opportunities for young fellows to be exposed to basic science research.

Finally, we should demonstrate our passion to young scientists by exhibiting good science and explaining to them why we are pursuing basic science. This is how many of us became interested in basic research. Japanese scientists should encourage young fellows to attend scientific meetings and expose them to the best science. Attending inspiring and exciting presentations encourages young scientists to think that they too can reach similar levels of achievement someday by working hard. The Japanese Circulation Society plans to initiate a Japanese version of BCVS (Council on Basic Cardiovascular Sciences in the American Heart Association) called BCVR (Council on Basic Cardiovascular Research), meeting in January 2018 (Personal communication with Drs Issei Komuro [University of Tokyo] and Yoshihiko Saito [Nara Medical School]). This will be a fantastic opportunity to motivate young fellows to conduct basic science research in the field of cardiovascular medicine.

What Should We Learn From This Situation?

The situation in Japan is sending a warning to investigators in the United States and other countries. Although the number of basic science publications from the United States has not dropped significantly yet,1 the number of PhD students studying life science is slightly declining.8 In addition, there has been a sharp drop in the overall success rate of National Institutes of Health research project grant proposals (32% in 2000 versus 18% in 2014), and the future funding situation
does not appear optimistic (Figure 2). Young scientists have been voicing concerns about career development because of the difficulty in securing funding and the slim support from their host institutions, which may soon lead to decreases in the number of young scientists in the United States. Thus, the condition of cardiovascular basic science in Japan may reflect potential problems in the United States and suggests that, if current conditions continue, the United States may follow in the same path.

The existing strong infrastructure for basic science, rigorous peer-review system, and strategic distribution of research funding have successfully supported the fundamentals of basic science in the United States even during recent financial downturns. Nevertheless, some of the solutions discussed above may be applicable to the potential problems that exist in the United States as well and may help increase funding for cardiovascular research and attract more young scientists to the field. Basic scientists in the United States may possibly be facing a decrease in public research funding because of a loss of trust by the general public in science in general and in cardiovascular medicine in particular. The number of patients experiencing heart failure has not dropped significantly. Worse, age-adjusted total cardiovascular disease mortality rates have increased slightly recently. The cost of health care remains high, and cutting-edge technology is often unaffordable for many people in the United States. Regaining that trust requires demonstrating the outcomes of cardiovascular research in a way that nonscientists can understand easily. Many subjects in basic science require time and effort before their significance becomes known. Even so, we must convey with passion the rationale and potential importance of these studies to the public and to the young generation. In addition, our research community should spend significant amounts of time and resources to provide young fellow scientists with a better learning environment, so that the next generation of scientific leaders can seamlessly extend our efforts to fight against cardiovascular disease through basic science discoveries.

**Acknowledgments**

We thank Drs Issei Komuro (University of Tokyo) and Yoshihiko Saito (Nara Medical School) for discussion. We also thank Daniela Zablocki for critical reading of the article.

**Sources of Funding**

This work was supported in part by US Public Health Service grants HL67724, HL91469, HL102738, HL112330, and AG23039 (Dr Sadoshima) and by the Leducq Foundation Transatlantic Network of Excellence (Dr Sadoshima).

**Disclosures**

None.

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Circ Res. 2017;121:314-316
doi: 10.1161/CIRCRESAHA.117.311411

Circulation Research is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2017 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7330. Online ISSN: 1524-4571

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World Wide Web at:
http://circres.ahajournals.org/content/121/4/314

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