Translational medicine in China

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Translational medicine has recently experienced an upsurge in interest and funding worldwide. Many translational research programs, centers and institutes have been rapidly established. In this short comment, we provide a brief view of the progress in translational medicine in China.

As Dr. Marincola clarified in 2003, translational medicine as a multidisciplinary science from basic research to medical applications has been considered as a two-way road: bench-to-bedside and bedside-to-bench [1]. The “Bench-to-Bedside Program” was originally developed within the US National Institutes of Health (NIH) to support research teams seeking to translate basic scientific findings into therapeutic interventions for patients and to increase understanding of important disease processes. However, bedside-to-bench efforts have regrettably been limited because of poor understanding of scientific aspects by full-time clinicians and poor appreciation for the difficulty in dealing with humans by basic scientists [1]. Therefore, the NIH Clinical Center has changed the name of the “Bench-to-Bedside award” to “Bedside-to-Bench award” for emphasis on the back-and-forth cycle of bedside-to-bench and back on patient volunteers, without whom the translational process could not occur (<http://www.cc.nih.gov/cc/btb/>). A successful application of bedside-to-bench and bench-to-bedside in China can be traced to Dr. Liu Shih-Hao for his discoveries in calcium and phosphorus metabolism in the early half of the last century, leading to the industrial production of 1,25-(OH)₂ VitD and its use as a common therapeutic medicine to treat osteomalacia and renal osteo-

dystrophy in the clinic. Currently, Dr. Zhong NanShan, a well-known physician and scientist who is known for his significant contributions during the SARS outbreak in 2003, has successfully applied this bedside-to-bench-to-bedside method in his medical practice, including the use of artemisinin in the management of malaria, the use of arsenic in the treatment of leukemia, and artificial infection with malaria parasites linked to anti-lung cancer therapy [2,3].

Funding support for translational medicine has also been increased recently. The UK government has approved a 30% funding increase (around £775 million (1.2 billion USD) over five years) for translational research focusing on high-priority disease areas such as cancer, heart disease and dementia [4]. In the United States, despite the flat budget for fiscal year 2013, NIH will give the National Center for Advanced Translational Sciences (NCATS) an 11%, or 64.32 million USD, increase in fiscal year 2013 to 639.033 million USD (http://www.nih.gov/about/director/budgetrequest/fy2013_testimony_house.pdf).

In China, the National Natural Science Foundation of China, one of the largest financial resources for research funding, approved a budget of 18.27 billion RMB (approximately 2.9 billion USD) for fiscal year 2011, which is an 89% increase from 9.65 billion RMB (approximately 1.52 billion USD) for fiscal year 2010 (<http://www.nsfc.gov.cn/nsfc/cen/ndbg/2011ndbg/04/index.html>). Projects with potential translational research are strongly encouraged and have priorities over more speculative applications. Also, from the first symposium on translational medicine in China in 2007 and the Sino-America Symposium on Clinical and Translational Research in 2010, tens of Institutes or Centers

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for translational medicine have been established in China. Among these, the establishment of the Translational Medicine Center of the Chinese Academy of Medical Sciences (CAMS) and Peking Union Medical College (PUMC) in Beijing can be considered a milestone toward the development of translational medicine in China as announced by Dr. Chen Zhu, the Minister of Ministry of Health of China [5,6]. All this support has promoted the discoveries of new drug targets, devices and biomarkers for diagnostics arising out of basic science laboratories in China. In 2011, Dr. Hui LiJian's research team developed a novel strategy to generate functional hepatocyte-like cells for liver engineering and regenerative medicine [7]. Dr. Zhang XueMin and colleagues discovered that CUE domain-containing protein-2 (CUEDC2) is a crucial determinant of resistance to endocrine therapies in breast cancer [8]. Dr. Yan Jun's laboratory found that dermal IL-17-producing $\gamma\delta$ T cells play a pivotal role in skin inflammation and may represent a novel target for the treatment of psoriasis [9]. In addition, many notable discoveries have been made in the fields of translational research including cancer [6,8,10–15], innate immunity and autoimmune diseases [9,16–22]. There is no doubt that all of the supportive efforts in translational medicine will enable moving these discoveries into clinical investigation with patients.

Translational medicine is not a magic word covering all aspects of the sciences but rather is a tool to bridge the gap between basic research and clinical practice to enhance the efficiency of diagnosis, treatment, or prevention of diseases. Translational medicine is carried out by integrating areas of expertise through a broad spectrum of disciplines [2,23–26]. The successful development of translational medicine depends not only on the multiple partnerships among translational research talents, centers or institutes, agencies, and the government, but also on the collaborations between China and other countries, sharing the understanding, methodologies, research protocols and resources [24].

The ultimate goal of translational medicine, as mentioned by Dr. Liu DePei, the former president of CAMS and PUMC, is the development of new treatments and insights towards the improvement of health across populations [26]. He proposed the “9P-3P” medicine structure, which represents protecting health, promoting health, prolonging a healthy life span, predicting diseases, pre-warning of diseases, preventing diseases, population policy, personal participation, and personalized medicine. Among the elements of “9P” medicine, prolonging a healthy life span, pre-warning of diseases, preventing diseases, and personalized medicine are the fundamentals and are called the “3P” medicine. The “9P-3P” medicine system may provide directional guidance for the development of future translational medicine endeavors [26]. Translational medicine will undoubtedly have a brilliant future and will impact the improvement of human healthcare and the growth of

national economics.

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