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Translational medicine in China: Awareness is increasing and research is advancing

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Translational medicine, which was first described by the director of the National Institutes of Health in 2003, has received worldwide attention. It is now well understood by Chinese physicians and scientists that this people-oriented process can provide a bridge between basic science and clinical practice, by considering clinical problems. Translational medicine involves identification of the problems that physicians encounter during the diagnosis and treatment of patients, finding solutions to these problems through systematic and multidisciplinary scientific studies, and eventually finding solutions that are useful to the physicians. This relatively new concept can help professionals in both basic science and clinical medicine through improved communication between these two groups. This exchange of information is expected to increase the ability to use scientific research to solve clinical problems, thereby supporting a patients-centered health system.

Although the concept of translational medicine has only been specifically described in recent years, such a process has successfully been used by many accomplished Chinese physicians and scientists over the past decades. The principles of basic science and clinical medicine have been combined to achieve many advances, such as the development of statins and the percutaneous treatment of cardiovascular diseases in the later part of the 20th century. Some well-known researchers such as Prof. Liu Shih-Hao, who laid the foundations for the development of endocrinology in China, conducted much of their research according to the principles of translational medicine. The work of numerous other researchers has also helped us to understand these principles.

Many areas of recent medical research in China have followed the principles of translational medicine. Some of these are described below.

The worldwide incidence of cancer is increasing, and improved methods of diagnosis and treatment seems to be urgent. Various novel and practical methods for the diagnosis of malignancy have been explored by scientists and physicians. For gastric cancer, differences that have been identified in surface-enhanced Raman spectroscopy findings between the plasma of gastric cancer patients and of healthy volunteers may develop a clinical tool for non-invasive screening. For breast cancer, computer-aided technology using a dual S-shaped logistic model can quantify the curves of breast lesions, and may be useful for distinguishing between malignant and benign tumors on dynamic contrast-enhanced magnetic resonance imagines. Molecular-targeted therapy for malignant tumors, is highly selective, with low toxicity and a high therapeutic index, and may eventually provide better outcomes than current therapeutic options such as standard chemotherapy and radical surgery. For example, Wang and Chen discovered that trans-retinoic

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acid induces differentiation in leukemia cells, which led to a significantly increased cure rate for acute promyelocytic leukemia. These examples illustrate the process of identifying questions at the "bedside", studying them in the laboratory, and then using the laboratory findings to develop solutions for use at the "bedside".

Many studies aimed at finding practical solutions to existing problems are under-way. Two important areas of such research are prevention of human immunodeficiency virus (HIV) infection and detection of early osteoarthritis (OA). Prevention of the spread of infection is important for an epidemic disease. The HIV virus-like particles developed at Jilin University, are considered to be safer than a live attenuated or inactivated HIV vaccine because of their lack of viral genome, and have been shown to elicit a specific immune response when injected, which may eventually help to reduce the spread of HIV infection. It is currently difficult to detect OA in the early stages, but recently ultrasound speed and ultrasound amplitude attenuation coefficient were used to assess trypsin-induced proteoglycan depletion in the articular cartilage of pig femurs, which may provide a method of assessing cartilage matrix integrity and early OA.

In the relatively new field of regenerative medicine, practical uses for mesenchymal stem cells (MSCs) are under investigation. In the Cell Therapy Center of Xuanwu Hospital, a new superparamagnetic iron oxide agent, Molday ION Rhodamine-B™, was used to label cynomolgus monkey mesenchymal stem cells (cMSCs) to investigate the biophysical and magnetic resonance imaging properties of these cells *in vitro* and *in vivo*, which may help to develop a method of using this agent to track transplanted cells *in vivo*. This procedure may be helpful for the investigating the transplantation of allogeneic and autologous cells during cell therapy. Another *in vitro* study investigated factors associated with the accumulation of intramuscular fat in pig, which is believed to affect the quality of meat obtained from domesticated animals.

The studies discussed above show that translational medicine can be used in many fields, including agriculture and medicine. Many study findings have already provided practical improvements to people's lives, such as the use of surface electromyography at Beihang University to monitor local muscle fatigue in the bicep brachii muscle and develop the Borg scale to monitor muscle fatigue during machine operation, which may help to decrease occupational injuries.

The ultimate goal of medicine is to serve the patients, and the ultimate goal of all studies in different fields is to serve the people. Our scientists and physicians will continue to work together to find ways to use the seemingly endless scientific research possibilities to provide benefits to patients.