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Building a translational medicine powerhouse in China

Those involved in translational medicine research in China admit that it has its challenges; but they know that their hard work is rewarded with the opportunity to make a real difference to patients. And with funding still on the rise despite a flagging economy, demand for skilled researchers is likely to continue to grow. That’s because the field has been receiving special attention from China’s central and regional governments in recent years. As a result, translational medicine—defined as a partnership between basic and clinical research to develop new pharmaceuticals, devices, and other medical products—presents many opportunities for researchers to build careers in biomedicine.

By Shawna Williams

Rui Shi, the associate chief physician of orthopedic oncology at West China Hospital in Chengdu, first heard the term “translational medicine” in 2008, when he took a temporary post in the hospital’s technology transfer office. Both the hospital and a provincial agency had put aside funds for translational research, and part of Shi’s new job was to help with presentations to hospital faculty about how to apply for the new grants—and how to conduct a successful project. In translational medicine, “the research question has to arise from clinical needs, and the needs of the clinic have to be solved by the lab,” Shi explains. “The clinic and the lab have to be combined, and the outcome has to be a new medication, a new device, or a new therapy—a new solution for a clinical problem.”

A major challenge, Shi says, is that clinical and basic researchers tend to have their own entrenched ways of approaching their work. To bridge the gap between bench and bedside, institutions like his must find ways to encourage the two camps to communicate with one another.

A culture shift

Luming Li, who heads the National Engineering Laboratory for Neurmodulation in Beijing, agrees. “Translational medicine research is multidisciplinary research,” he says. “It needs the right environment.”

Only relatively recently has China’s central government made fostering that environment a priority, but the shift is beginning to have an impact. Members of his laboratory, for example, collaborate closely with surgeons, engineers, and basic researchers, Li says. In 2014, China’s National Development and Reform Commission announced plans for five new translational medicine research centers, where basic scientists and clinicians will work side by side.

The first of these, the National Centre for Translational Medicine, is slated to complete construction in 2017 in Shanghai. With one building on the main campus of Shanghai Jiao Tong University and another at the affiliated Ruijin Hospital, the center “will promote the merger of basic and clinical techniques and methods in translational innovations,” says Guang Ning, Ruijin’s deputy director.

With 50 principal investigators and 300 beds for clinical trials, the center will focus on cancer as well as metabolic and cardiovascular diseases, he says. And to ensure that products make it to the market quickly, “there is enough space for pharmaceutical companies, and [we will] invite them to open their offices or laboratories in our building,” he adds.

To foster an interdisciplinary environment, one trait Ning looks for in potential recruits is “broad knowledge and skills in multiple disciplines.” That advice is echoed by Yuquan Wei, director of the National Key Laboratory of Biotherapy at Sichuan University in Chengdu. “Students in clinical medicine who are interested in translational medicine should gain experience in basic research and have a strong background … [in] diverse disciplines such as genomics, proteomics, structural biology, genetic engineering, developmental biology, immunology, the mechanism of human diseases, chemistry, and materials, among others,” he says, adding that similarly, “students in basic research who are interested in translational medicine should gain some knowledge of clinical medicine.”

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Shi concurs that translational medicine researchers need to build a strong knowledge base to succeed. “You need to discover the clinical needs ... you have to know how the lab works, and how basic research can provide the solution. At the same time you need to understand the basic concept of how to do technology transfer... [and] how research results could be finally transferred into the market,” he says.

Another critical skill, says Li, is communication. “I ask my students to visit hospitals and talk to patients so we can find how to help them,” he says.

So far, Chinese institutions have been more successful at attracting basic science researchers with the right experience than physician-scientists, says Xiao-Fan Wang, a professor of pharmacology and cancer biology at Duke University School of Medicine in Durham, North Carolina, who serves on the international advisory boards of two of the new translational medicine centers. But he notes the difference in salaries for physicians in the United States versus China: According to a 2014 survey by the news website Phoenix Innovation, the salaries of experienced Chinese physicians range from $5,520 to $18,480 per year, while the news website Medscape found in 2015 that primary care physicians in the United States bring in an average of $195,000 per year, and specialists annually earn $284,000. As a consequence, Chinese labs generally “don’t have people who really have the expertise to set up clinical trials to withstand the scrutiny of international experts when they publish their results,” says Wang. To cope, Chinese universities are beginning to develop their own equivalent of M.D./Ph.D. programs, he says, and are recruiting practicing clinicians domestically to join research teams.

Many newer initiatives also set up their facilities so that basic researchers share space with medical doctors. At the Shanghai Institutes for Biological Sciences (SIBS) of the Chinese Academy of Sciences, for example, “We ask the [basic science] researchers ... to work in our hospital one day per week and talk to doctors to try to find solutions to clinical problems,” says Ying Mao, vice president at Huashan Hospital and a principal investigator and adjunct professor at SIBS.

Translational medicine with Chinese characteristics

In collaborating with colleagues from different fields to push innovations to the bedside, many in the translational medicine field see a unique opportunity to improve healthcare in China. The five new translational medicine research centers “really want to recruit people to target some of the diseases more prevalent in China,” says Wang. For example, he says, the incidence of stroke and certain cancers of the digestive system is much higher in China than in the United States. Finding ways to prevent and treat such illnesses is a priority for many translational research institutions.

Keeping product costs down is another way in which researchers seek to meet local needs, says Li. “We want to help people not only in the cities, but also in the [relatively poor] countryside,” he says. “Those patients can be very sensitive to price.”

Shi recounts how his colleague Hao Liu, also a spinal surgeon, noted that imported artificial vertebral discs cost thousands of dollars each, so he set out to develop his own version. The resulting prototype, made by a Chinese company, is not only less expensive, but is as durable as commercially available artificial discs and more suited to the average anatomy parameters of Chinese patients, Shi says. It is currently in clinical trials.

Other projects seek to harness aspects of traditional Chinese medicine. Li, for example, collaborated with a doctor who is an expert in using acupuncture for pain control to develop an implantable device to mimic acupuncture’s effects. The device is currently being tested in animals to pave the way for human trials.

Another feature of translational medicine research in China is the relative ease of recruiting large cohorts of patients for clinical trials, researchers say. “You have this enormous population from which to collect samples,” Wang says. “It is relatively easy to get a patient population big enough for statistical analysis.”

And Wang says that a favorable funding environment is a critical element in the blossoming of translational medicine research. “The funding is much better now in China than in the United States, so a lot of young people make the tough decision to come back to China after training overseas, because it’s easier for them to build up their lab,” he says, and he expects that trend to continue.

Luyang Yu, a professor of cell biology at Zhejiang University who worked as a postdoctoral associate and associate research scientist at Yale from 2006 to 2012, is one of those returnees. In addition to his academic research, Yu is working to launch a startup company with three other scientists in Hangzhou—two of whom are friends he met at Yale. The company, CedarMed, is developing a test to predict atherosclerosis earlier than previously possible, which could enable doctors to better prevent negative outcomes such as heart attacks and strokes. “We feel that Zhejiang is a very good environment” for biomedicine, Yu says, citing startup funding the company has already received from the central, provincial, and city governments. He has also been cultivating contacts in the private sector and is confident that the startup will have no trouble attracting investment once more data has been generated.
Faculty Positions

The Institute of Genetics and Developmental Biology (IGDB), Chinese Academy of Sciences is a leading life science institution in China, and aims to address fundamental questions in modern agriculture and human health, making internationally recognized contributions in these fields.

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More information about IGDB can be found at [http://www.genetics.ac.cn](http://www.genetics.ac.cn) or [http://english.genetics.cas.cn](http://english.genetics.cas.cn). Interested candidates should submit a cover letter, curriculum vitae, representative publications, a statement of research experience and interests as well as the names and contact information of three referees to the Institute director Professor Weicai Yang by e-mail ([wcyang@genetics.ac.cn](mailto:wcyang@genetics.ac.cn)), copied to Ms. Jing Wang ([jwang@genetics.ac.cn](mailto:jwang@genetics.ac.cn)).
Looking to the future

At the meeting of the National People’s Congress in Beijing in March 2016, Premier Keqiang Li outlined the central government’s economic plans for the next five years, including a 9.1% boost in science funding in 2016, and priorities that include brain research, applications of genetic knowledge, and big data. The new plan “will strongly support translational medicine innovation in China,” says Ning. He adds that the government is reforming the regulatory system to make translational medicine research “more compliant.”

Andy Peng Xiang, a professor at Sun Yat-Sen University in Guangzhou, credits what he sees as accelerated progress in translational medicine research over the past decade not only to government funding but also to changes at universities and with researchers themselves. As he explains it, “A lot of universities in mainland China have formulated special policies to help their faculties accelerate the translation of basic research findings into practice or products,” such as establishing centers that put “researchers, doctors, and patients under one roof,” and encouraging collaboration with industry. And more researchers have become interested in the field as a way of directly benefiting patients, he adds.

China is not building its translational medicine capability from scratch, however; some internationally recognized researchers there have been doing strong work in the field for decades. Among them is Lingyun Sun, a professor of medicine at Nanjing Drum Tower Hospital. Sun has been exploring the possibility of transplanting stem cells since the late 1990s, and for the past 15 years has studied the question of whether so-called allogeneic mesenchymal stem cells (MSCs) can effectively treat autoimmune diseases such as lupus. With approximately 700 patients treated in clinical trials, MSCs are showing great promise, he says. The project has thus far attracted about US$10 million in funding from pharmaceutical companies and from national and local governments.

The five translational medicine centers planned by the National Development and Reform Commission are part of a movement toward strengthening the connection between bench and bedside, says Wang. The National Centre for Translational Medicine in Shanghai will be joined in a few years by two Beijing institutes, one for geriatrics and another for rare and refractory diseases: the Translational Science Center for Molecular Medicine at the Fourth Military Medical University in Xi’an, which will focus on precision medicine and cancer; and the National Translational Medicine Center for Biotherapy, part of the National Key Laboratory of Biotherapy in Chengdu. The latter will boast some 500 faculty members when it opens in 2018 or 2019, working in nearly 180,000 square meters on the main and medical campuses of Sichuan University, says Wei. Wei adds that the new center’s emphases will include gene therapies, vaccines and other immunotherapies, monoclonal antibodies and engineered T-cells, stem cells and regenerative medicines, and synthetic and natural small-molecule drugs, and that it will “establish a whole key technology chain from genomics to the research and development of innovative drugs, pilot-scale production, preclinical safety evaluations, clinical trials, and clinical treatment, all in a single institute.”

Moreover, the Translational Science Center for Molecular Medicine, funded with an initial investment of more than US$125 million, will aim to answer research questions such as how biological signals are regulated and what molecular mechanisms lie behind inflammation-linked diseases and cancer, says its director, Zhinan Chen. He expects the new center, which will boast state-of-the-art instruments, to rank among the top international translational medicine research centers.

Even under the best of circumstances, researchers say, translational medicine is challenging. Asked for his advice for younger researchers, Sun says, “It is essential that they should overcome many difficulties and challenges, even failure, before realizing successful translational medicine in the clinic.” His team, for example, spent seven years running animal studies to clarify issues such as whether MSC transplantation is safe, the optimal type of stem cell for transplantation, and correct dosage and timing; and evaluating long-term effectiveness before clinical trials could begin, he says.

But for those who persevere, the rewards are great, says Xiang. “Although translational medicine is time-consuming and challenging research, most of the time I do enjoy the process,” he adds.
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