



## Tokyo Medical and Dental University (TMDU)

# AT THE FOREFRONT OF BASIC AND CLINICAL LIFE SCIENCE RESEARCH AND EDUCATION

Tokyo Medical and Dental University (TMDU) is proud to have been founded, in 1928, as the first national dental school in Japan. Today, under TMDU President Takashi Ohyama, approximately 3,000 students are pursuing medical, dental, and life science degrees at TMDU, with a nearly equal number of students in undergraduate and graduate programmes. Undergraduates begin their career at the College of Liberal Arts and Sciences to ensure a well-rounded education. After moving on to the Faculty of Medicine or Faculty of Dentistry, students concentrate on a curriculum that is increasingly integrated between medical and dental sciences and utilizes an inter-professional educational approach, just as graduate students at TMDU have traditionally enjoyed. In all, TMDU offers over 200 life science degree programmes in its three graduate schools. In addition, thousands of patients are treated daily at the attached university hospitals of medicine and dentistry, institutions that further facilitate the school's educational efforts, basic and clinical research activities, and community service.

In 2012 Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) awarded TMDU a very substantial

grant to help its graduates gain an internationalized perspective through innovative and intensive education in English, critical thinking and global issues. This initiative, the Project for Promotion of Global Human Resource Development, will be fundamental in improving Japan's global competitiveness and enhancing ties between nations. TMDU also received funding for another large-scale project to foster direct international outreach. The Re-Inventing Japan Project — Support for the Formation of Collaborative Programs with ASEAN Universities — will promote student exchange between TMDU and ASEAN universities through the harmonization of academic curricula, the mutual recognition of credits, the strategic recruitment of international students and the deepening of TMDU's collaborations with its partner universities in Southeast Asia.

The university's three overseas research/education centres are also central to its educational and research goals. The Ghana–TMDU Research Center at the Noguchi Memorial Institute for Medical Research at the University of Ghana concentrates on the research of emerging and re-emerging tropical diseases, including malaria, HIV, tuberculosis and

neglected tropical diseases. The Latin American Collaborative Research Center for Colorectal Cancer in Chile builds on the foundation laid by TMDU, the Japan International Cooperation Agency (JICA) and institutions in South America to detect and treat colon cancer at the earliest stage possible. The third centre, the Chulalongkorn University–TMDU Research and Education Collaboration Center in Thailand, facilitates a great deal of cooperation between the two schools, especially in the dental field.

TMDU currently has 210 international students, who are predominantly enrolled in the graduate school. In fact, despite its relatively small size, TMDU has the largest number of international students in the medical and dental fields of any school in Japan. TMDU is also recruiting outstanding young scientists from around the world for assistant professorship positions focused on medical science research through its tenure track initiative. Another important part of the university's international outreach is the annual International Summer Program (ISP). Each year, TMDU invites approximately 25 students from Asia to visit TMDU for three days of lectures, poster sessions, cultural and social events, and laboratory tours. Many of these students



have since become graduate students at TMDU or other schools in Japan. ISP2013 — Biomaterials: From the Laboratory to the Clinic — will focus on the development and applications of biomaterials and bioengineering.

The TMDU Research Organization coordinates all research activities at the school, and the recently established Bioresource Center collects and maintains high-quality bioresources and promotes the application of cutting-edge medical technologies. TMDU also plays a central role in MedU-Net, a networking initiative created by medical schools that accelerates industry–government–academia cooperation. One such example is a project with Dai Nippon Printing (DNP) to create nanomedicine products. Another example of this initiative is a project with Sony Corporation that is already bearing fruit through the development of an innovative technique which identifies cancer cells by their unique electrical signatures.

In these and all of its activities, TMDU has one ultimate goal: to serve the needs of patients and their families, in Japan and around the world, by working to fulfil its mission statement of “Cultivating Professionals with Knowledge and Humanity”.

Two areas of stem cell research at TMDU are currently delivering significant results.

### Cartilage and meniscus regeneration with synovial stem cells

Articular cartilage and meniscus — cartilage in the knee — have poor healing potential and when injured result in osteoarthritis of the knee. Mesenchymal stem cells derived from synovium have been shown to be a superior cell source for cartilage regeneration compared to those from other mesenchymal tissues due to their higher rates of colony formation, proliferation potential with autologous serum and *in vitro/vivo* chondrogenic potentials. Ichiro Sekiya's laboratory has found that approximately 60% of synovial mesenchymal stem cells placed on cartilage and meniscus defects adhere to a defect within 10 minutes, and this action has resulted in cartilage and meniscus regeneration in pig models. Based upon previous basic research studies they have performed, his lab has commenced transplanting synovial stem cells arthroscopically in a clinical study for the treatment of cartilage defects, resulting in the regeneration of cartilage and a marked decrease in symptoms in most patients without any adverse effects over the last 4 years. The lab is planning a new clinical study for meniscus regeneration using synovial stem cells.

### The feasibility of adult stem cell therapy for gastrointestinal diseases

Embryonic stem (ES) cells and induced pluripotent stem (iPS) cells hold great promise for regenerative medicine while adult stem cells offer another physiological and safe option for treatment. However, practical applications of adult stem cells in various clinical situations are limited mainly due to the dormancy of adult tissue stem cells. Mamoru Watanabe's research group established the original culture protocol for murine adult colonic epithelial stem cells that maintain self-renewal and multi-differentiation properties. The group found that a single Lgr5+ adult colonic epithelial stem cell could expand unrestrictedly *in vitro* and regenerate functional normal epithelium *in vivo*. This ‘epithelial transplantation’ showed therapeutic benefits in an acute colitis model (*Nature Medicine*, April 2012). In future, these culture technologies will provide a new avenue for cell-based therapies for various gastrointestinal disorders and will also enable the application of personalized medicine based on stem expansion technology using a patient's own biopsy samples. ■



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