

**National University Corporation  
Tokyo Medical and Dental University**

**Designated National University Corporation Initiative Report**

**“Total Health Care” Through the Generations for All Mankind**  
**Forming the World’s Leading Health Care Science Base**  
**by Cultivating Professionals with Knowledge and Humanity**

Tokyo Medical and Dental University (TMDU) strives to become the world’s leading future-oriented education and research center through education and research at the highest level in science related to life and health; fields of global and universal importance for all humanity. Through this endeavor, we will realize the best, sustainable “Total health care” system for all mankind. As the only national comprehensive medical/dental university in Japan with the goal of being ranked in the world’s top 50 medical and dental research center by the end of fiscal 2033 (end of the 5<sup>th</sup> mid-term target period), we will distinguish ourselves as a medical research-oriented university that innovates and contributes to the establishment of “Total health care” in Society 5.0. In an ever-changing, data driven society, we will establish key areas of focus in research and a system to optimally adjust to various changes ahead. TMDU is committed to becoming a leading university in health care and to contribute continuously to innovative basic research and applied sciences with high social impact.

There is an urgent need to foster and develop *Clinician Scientists* (Physicians that conduct high level research) <sup>\*1</sup> who have been making significant contributions to biomedical research around the world, and top medical data scientists who actively work in a global arena. TMDU will implement university reforms to promote the elite education of these *Clinician Scientists*, strengthen the education and research system of medical data science, and establish an ideal system that develop excellent young researchers. We will carry out drastic reforms to become a university that makes social impact on a global scale by capitalizing on our unique ability to make swift decisions and efficient transformations, and by collaborating closely with institutions, faculties and businesses across Japan and internationally. Our unique characteristics and advantage over other universities enable us to make drastic reforms to become a world-class university that progresses continuously over the next decade and beyond in a constantly evolving society.

<sup>\*1</sup>: A *Clinician Scientist* is a physician or dentist who specializes in medical care while also focusing on basic research. To date, they have helped accelerate breakthrough in medicine, with 37% of Nobel Prizes in Medicine or Physiology awarded to *Clinician Scientists*. They are essential assets in elucidating the pathogenesis of human diseases and understanding fundamental life phenomena. However, in recent years their numbers have decreased by one third worldwide, development of *clinician scientists* is therefore a major concern across the globe.

## **I. Our Strengths, Characteristics and Challenges**

### **[Research Education]**

#### 1. Strengths / Characteristics

TMDU is a research intensive medical and dental university selected by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) for Top Global University Project (Type A) and as the program for promoting the enhancement of research universities, and is ranked 50-100 in The QS World University Rankings in the Medical field in 2019 and 10<sup>th</sup> in Dentistry. In addition to the ongoing entrance examination reforms, we are promoting reforms in advanced research fields and have set up a preemptive medical, dental and engineering course as part of graduate school reform under the MEXT's Doctoral program for Data-Related Innovation Experts.

In particular, we continue to strengthen our research capabilities by setting priority research areas and establishing an Organ and Tissue Neogenesis Consortium, Medical Innovation Consortium, and Rare Diseases Consortium. We are developing internationally recognized and unique research in organoids (mini-organ), hard tissues of bones and teeth, development of novel medicine and medical devices and intractable disorders, while conducting world-class research in oral science. Each consortium is **highly agile** and consists of **both basic researchers and *Clinician Scientists* who have bed-to-bench and bench-to-bed research mindset**. In addition, the university's fundamental philosophy is to foster clinicians with high scientific thinking skills (who we call *Scientific Clinicians*), by providing various opportunities for research interaction from the early stages of undergraduate

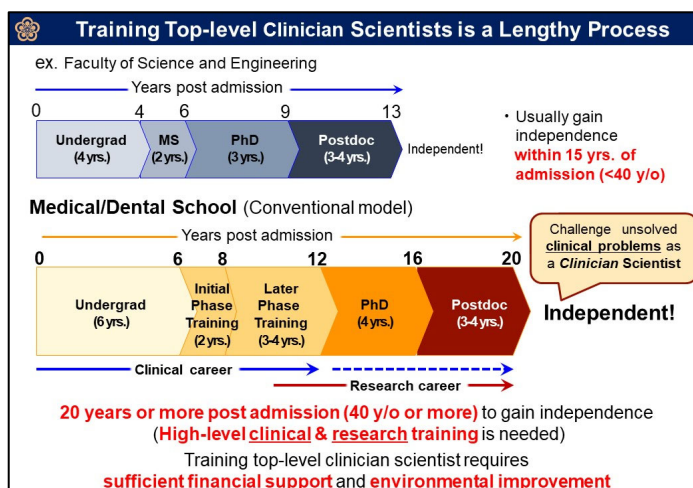
studies and by constantly reviewing the structure and function of graduate schools. We have thus produced many *Scientific Clinicians* whose fundamental understanding of research results enable them to embrace untraditional concepts and advanced treatments, and can therefore deliver future medical care quickly to patients.

In addition, a Young Innovative Medical Scientist Unit has been set up to train and develop young researchers into becoming top researchers. Traditionally, researchers achieve their most significant results at TMDU in their 30s and 40s when their research work is at its most active, before going on to achieve further results in other institutions. One of our strengths and distinguishing characteristics is that research is not restricted to our campus. There have been many examples of flexible research collaborations with research facilities across Japan and internationally, in various areas of advanced medical research.

## 2. Challenges

To train medical and dental researchers who can solve various issues involved in “Total health care”, resulting in high societal impact, they must first gain an understanding of medicine, dentistry, and clinical care, then put this knowledge into use in clinical practice. This is a lengthy learning process that requires a complex educational program. TMDU is what is commonly known as a “small university”, composed of a School of Medicine and a School of Dentistry, providing educational training for healthcare professionals. After graduation, many of our students go on to become medical professionals, such as doctors and dentists, each possessing high scientific analytical ability. It is therefore essential to devise ways to seamlessly cultivate students from the undergraduate level into becoming future researchers who will continue to produce outstanding research results. In disciplines such as humanities, social sciences, science and mathematics, we have yet to reach the forefront levels of education.

In research, strategic planning is necessary to recruit talent in the areas of artificial intelligence and data science, required for future development of our university. To address this, an M&D (Medical and Dental) Data Science Center will be established in April 2020. In the future, further strategic planning will also be required in this area. Also, due to space constraints of TMDU, facilities where top scientists can gather, discuss, and carry out research are limited. There are no faculties of humanities or social sciences at present, however, it is evident that the enhancement of the area of ELSI (Ethical Legal Social Issues) is becoming essential as science advances.



## [Social Collaboration]

### 1. Strengths / Characteristics

Taking full advantage of the characteristics of being a small university, under the strong leadership of the President, we established an integrated system comprising of the Institute of Education, the Institute of Research, the Institute of Integrated Hospital Administration, the Institute of Global Affairs, the Institute of Information Technology, and the Institute of University Innovation Advancement. This was followed by the introduction of a provost system and the establishment of an IR office to implement constant reform. In addition, the President’s Advisory Board was assembled to plan and implement future visions.

On the management side, under the MEXT’s Open Innovation System, we have installed a mechanism to establish affiliate/open innovation programs to promote industry-academia collaboration. We have also begun further management strategy development under the Cabinet Office’s Program for Enhancing an Environment of National Universities for Creating Innovation.

### 2. Challenges

While the President's Administrative Council has many external corporate committee members, it still requires appointment of those who are deeply committed to the management of the university. Realization of the provost system is still in progress. Furthermore, because TMDU is a specialist university in medicine and dentistry, there is room for development in collaborating with non-medical industries. Academia-government collaboration with scope for contributing to policy proposals and large-scale collaboration with industries (or business associations) are yet to be established. We have seen some increase in income from industry-academia collaboration, patents, joint research etc, but there is still room for improvement compared to the world's top universities.

## II. Fundamental Goals for the Overall Initiative

TMDU aims to become one of the world's leading research and education hubs that solves global challenges and the world's biggest problems in health and medical care. We aim to **rank in the world's top 50 universities for Medicine and first in the world for Dentistry**. By making the most of TMDU's strengths and characteristics, our unique ability to implement speedy and ambitious reinforcement and collaboration in the fields of humanities, social sciences and data science, we will pursue transformations in with the following fundamental goals under an organized management system.

### Fundamental Goal 1: Excellence in Research Education: International Center of Excellence for Medical/Dental/Data Science

We will establish new curriculum and courses and implement systematic reorganization of graduate schools to form a Global Research and Education Center to cultivate advanced physicians who will contribute to the realization of "Total health care". Our outstanding research in medicine and oral sciences will be powered by robust medical data science. In addition, we will promote world-leading advanced medical/dental/data science research through close collaboration with top research institutions in Japan and internationally.

We will establish a world-class medical research university human resource development model by building a seamless and long-spanning *Clinician Scientist* (research doctor) training system from undergraduate level to independent researchers (PIs). To that end, we will provide mathematics, data science and top research education to all undergraduate students, as well as connections to cutting-edge education and research at graduate schools. Our vigorous reform plan also includes collaboration with outstanding facilities teaching humanities and social sciences, establishment of multi-layered support to selected outstanding graduate students and young researchers.

### Fundamental Goal 2: Contribution to Society: Solving Social Issues as a Role Model for Medical Research Universities

We will further strengthen our governance system, a major strength, add an Institute of Innovation promotion (TBD) to an integrated institute system, and make full use of the IR office directly under the President to actively promote reform as an independent medical research university. We will continue to contribute to society as a comprehensive medical/dental university that truly addresses the needs of society.

New facilities will be established to bring together outstanding researchers and scientists from within and outside the university. Also, we will function as an industry-government-academia (private) collaborative research facility as a base for thinking and solving problems in the fields of advanced medical/dental/data science cross-functionally across industry, government, academia and the public.

## III. End of FY2033 Targets: Activities and Achievement Indicators

In order to achieve the fundamental goals, TMDU must also set goals to strengthen its research capabilities, talent development/acquisitions, advance international collaboration, enhance governance, promote social collaboration, and strengthen its financial position. In these six categories, we will develop and implement concrete plans for achieving the status as one of the world's top universities. TMDU considers the following universities as

benchmarks: Johns Hopkins University (2019 QS ranking 50<sup>th</sup> overall/24<sup>th</sup> in Medicine) with whom we collaborate in several areas; King's College London (2019 QS ranking 33<sup>rd</sup> overall/20<sup>th</sup> in Medicine/3<sup>rd</sup> in Dentistry) with whom we have already established a close connection; and Imperial College London (2019 QS ranking 9<sup>th</sup> overall/12<sup>th</sup> in Medicine). Imperial College London (ICL) is a relatively new university that we have been collaborating with in education and research; and thus we feel ICL is a model university to aspire to. Although ICL ranks lower than Oxford and Cambridge Universities in pure science research, it shows its presence by conducting research with higher Social Impact. We plan to raise our strengths to world-leading level by taking advantage of our university's unique characteristics, adding the excellence of data science as a new strength, and using the benchmark universities' efforts as reference points to systematically overcome our weaknesses to attain even higher levels.

## **[Strengthen Research Capability]**

### **(1) Fundamental Rationale**

#### **A. Current State and Self-Assessment**

##### **◇ Internal and External Organizations for Planning and Evaluation of Research Strategies**

TMDU is a research-intensive comprehensive medical/dental university. Since we are categorized as a small university, we are disadvantaged compared to universities with larger numbers of researchers and students, when research strength is evaluated by the total number of research products. In the 2019 QS World University Ranking for Medicine we ranked 50-100<sup>th</sup> in the world / 3<sup>rd</sup> in Japan; for Dentistry 10<sup>th</sup> in the world / first in Japan. In the 2020 THE World University Rankings for clinical, preclinical and health care fields we ranked 74<sup>th</sup> in the world / 3<sup>rd</sup> in Japan. From 2014 to 2018, we were ranked 10<sup>th</sup> and 1<sup>st</sup> in the medical field and dental field in Japan respectively (by our inspection) when assessed by the number of publications which fall into the top 10% in citation. Top 1% highly-cited papers came in 9<sup>th</sup> in the field of immunology, and in 5<sup>th</sup> in molecular biology (published by Clarivate Analytics Japan, April 19, 2018). Although the quality of these publications is high, we still need to enhance and improve the level of cutting-edge research and increase the volume (number) of top publications. For this purpose, an Institute of Research was set up in FY2017 to formulate and promote a university-wide research strategy. This strategy was planned and examined at the Institute's Research Strategy Meeting, which comprised of top researchers from the university. However, we have yet to devise a system that allows peer-review from researchers outside of the university, which leads to the planning of the next strategy.

##### **◇ Our Key Research Areas**

The Research Strategy Meeting, together with the President, established key research areas centered on life-course medical research, with the aim of providing solutions to various problems in medicine, dentistry and health care. As an environment for nurturing and developing key research areas, the Organ and Tissue Neogenesis Consortium, Medical Innovation Consortium, and Rare Diseases Consortium have been established. We have been carrying out research on organoids (mini-organ), intractable diseases, research for development of novel medical devices and treatment and research in the field of hard tissues and oral science. We have been the leading, and often the only, university in Japan to conduct research in some of these areas. In parallel, the council will determine the direction of multidisciplinary collaboration and the development of young researchers. However, developing world-class areas of unique specialism requires further bold reforms.

##### **◇ Data Science**

Medical data entails an extraordinary volume of multidimensional information that requires strict management of personal information. Data science-related centers are being established nationwide, but none specializes in medicine/dentistry or medical care. TMDU will establish the M&D Data Science Center in April 2020 and will deploy experts in the field of data science and artificial intelligence, which are essential for future life science research, to promote the next generation of medical/dental research based on multi-layered medical data and to focus on the realization of intelligent hospitals. **Strategic measures are needed, however, to continue to produce excellent research results that further reinforces our research capability.**

#### ◇ **Developing Young Researchers**

Traditionally, researchers achieve their most significant results at TMDU in their 30s and 40s when their research work is at its most active, before going on to achieve further results in other institutions. In the past two years, the Young Innovative Medical Scientist Unit was established in order to train and develop young researchers. To date, 16 researchers have been assigned to this unit, which supports the generation of new research fields while fostering future top researchers. In addition, the TMDU Advanced Research Institute was newly established in FY2018, staffed with senior researchers who have outstanding research credentials. They not only conduct advanced research themselves but act as advisors for the younger generation of researchers. Also, with the support from the program for promoting the enhancement of research universities, we set up a system for the URA office to provide guidance on writing competitive grant applications and scientific papers with the aim of supporting and improving research capabilities of young researchers. Various other forms of support are available for outstanding young researchers. These include the Yushima Young Academy teaching for academic presentations in English and research funding provided by the Presidential Young Investigators Award. We are in the process of nurturing top-level young investigators. We understand that **it is critically important to increase not only human resources but to provide appropriate equipment/facilities in order to strengthen our international competitiveness in advanced large-scale research and to facilitate creative research for our top young researchers.**

#### ◇ **Domestic and International Collaborative Research and Humanities-Science Research**

TMDU does not have a Faculty of Humanities and Social Sciences or a Faculty of Science and Mathematics; and we consider this a disadvantage in our goal of being able to develop and complete multidisciplinary scientific research within our own campus. As a solution to this problem, we have so far collaborated flexibly with leading research facilities outside the campus, for example RIKEN, the National Center of Neurology and Psychiatry, the National Cancer Center Japan, and the National Center for Child Health and Development, as well as the Tokyo Metropolitan Research Institute, in an effort to facilitate outstanding research, by involving and training young researchers together. Also, under the Union of Four Universities in Tokyo - Tokyo University of Foreign Studies, Tokyo Institute of Technology, and Hitotsubashi University - we have established a joint research system to broaden our research scope. On the other hand, although there have been many joint research projects carried out with international research institutions, the ratio of co-authored publications still remains low at 21.9%. Therefore, we need strategic collaboration with top international research institutions. **There is room for further improvement in the selection of priority research areas, enriching of multidisciplinary research areas and the number of fully-collaborative research with the Union of Four Universities in Tokyo as well as other research universities in the vicinity of TMDU.**

#### **B. Initiative Direction**

Based on the current issues, we will establish a system for collaborative research and research evaluation in order to strengthen our research capabilities and our university's distinctive key research areas. We will add a new focus, data science, and promote and assist work in this priority research area. We are also committed to encourage and support unique and innovative research by top young scientists.

◇ **Strengthen the Research Strategy Meeting** whose main responsibilities are formulating priority research areas, creating multidisciplinary fusion areas, coordinating with top research institutions in Japan and internationally, and establishing a creative research system and environment for young researchers. In addition, an **Integrated Research Evaluation Meeting** (TBD) will be set up to develop and evaluate our research strategy and to maximize our research potential. The Meeting will consist of top researchers from both within and outside the university, from across Japan and abroad, and will support our research to achieve the best possible results.

◇ Form an International Research Center in **key research areas** centered around our ongoing life-course research by collaboration with top research facilities in Japan and internationally. In addition, through collaboration between each key research area and oral science, we will promote unprecedented collaborative research in

medicine and dentistry.

◇ As an innovative approach that does not fall into the existing framework, the newly established M&D Data Science Center will promote **data science research specializing in medicine/dentistry**. Data Science will support, and drive research related to medical practice and medicine/dentistry, forming an international research center for **advanced medical and dental information science**.

◇ With prospects for the future, the **Young Investigator Support Center** will be established with a focus on providing holistic support for young researchers, who are integral to the strengthening our research capabilities. Set up under the leadership of the President, the **Top Science Incubator function** will be enhanced by providing support in the areas of career development, human resources and research expenses, and will feature a supervisor system made up of international researchers.

◇ Based on the heritage of historical collaboration with neighboring top national and private universities and the Union of Four Universities in Tokyo, the **Division for Interdisciplinary Research Collaboration (TBD)**, which addresses both domestic and international scientific issues, will be established in TMDU to promote fusion of arts, science and technology, multidisciplinary collaborative research, and advanced research.

## **(2) Initiatives in Detail**

### **1. Plan University-wide Research Strategy, Progress Evaluation and Advice from the Research Strategy Meeting and the Integrated Research Evaluation Meeting (TBD)**

The **Research Strategy Meeting** will be enforced, by inviting top researchers from across Japan and internationally as ad hoc strategic planning advisors, to develop a strategy focused on promoting world-class research. With this new system, we will establish and expand key research areas, create multidisciplinary integrated fields, which are essential for promoting outstanding research, collaborate with top research institutions in Japan and internationally, and build a creative research facilitation system by young researchers. In FY2022, a new **Integrated Research Evaluation Meeting (TBD)** will be launched by top researchers both on-campus, domestically and internationally, as an organization to provide advice and evaluate research direction, strategies, and their outcome of the entire university in order to develop, formulate and realize higher-level research strategies.

### **2. Promote Key Research Areas: Further Development of Prominent Areas**

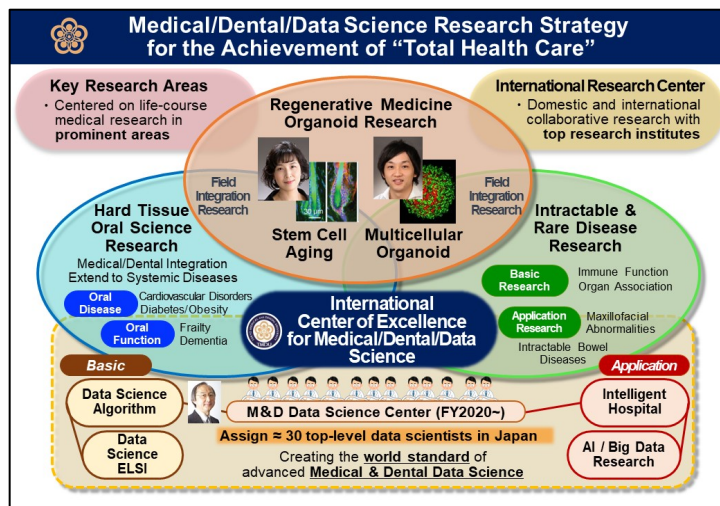
From the areas focused by the three consortia currently in operation (Organ and Tissue Neogenesis, Future Medical Development, and Rare Diseases), and oral sciences that associate with these consortia, we will select **Organ and Tissue Neogenesis / Organoid (mini-organ) Research, Rare and Intractable Diseases Research, and Hard Tissue / Oral Science Research**, such as bones and teeth, as our **key research areas**. We will employ multiple strategies to further strengthen our priority research areas.

1) Rapid reinforcement of research systems led by the President / Institute of Research by restructuring and cost allocation: We will continue to **promote and conduct research flexibly and boldly while maintaining the core within the consortium's three key areas**. We also will reorganize research areas in the three consortia into a new, single consortium and expand key research areas where appropriate. In addition, we must find competitive funding for expansion of the core research area, while allocating funds, equipment and human resources in a flexible and efficient manner.

2) Radical reform of hard tissue and oral science research: **Oral science** will establish a system to collaborate with the three consortia aiming for the world's top level research that delve into oral science and its association with systemic diseases. Through this we aim to achieve unique medical and dental collaborative research.

3) Evaluation at international level by top scientist advisors to advise and strengthen joint research; collaboration with top research facilities; and facilitation of exchange of human resources: Collaboration with the Hubrecht Institute and Cincinnati Children's Hospital for regenerative medicine and organoid (mini-organ) research, collaboration with the National Institutes of Health (NIH) for rare and intractable disease research, and Michigan University for hard tissue and oral science research, aiming at international joint research with multiple top research institutes in each key research area, thereby making the key research area an international research center. In FY2020, top overseas researchers will be assigned to each key research area as scientist advisors, who will regularly give advice and evaluations and work to improve the research system. Currently, there are **107 overseas partner schools**, but we aim to enhance the **quality of collaborative research** going forward. By the end of fiscal 2033, we will establish **10 or more overseas partner schools** that will serve as strategic hubs for strategic education and research collaboration on five continents. Through these, we aim to increase the quality and quantity of international co-authored publications.

Specifically, we aim to increase **international co-authorship publication ratio** from 21.9% to **40%** by the end of FY2033 based on the ratio of Johns Hopkins University. \*2



\*2: The ratio at Imperial College London, one of the target universities, is 60%, but in view of the exclusion of medical staff from total faculty members and the geographical characteristics of Europe, we have set our goals about the same as Johns Hopkins University at 40%. In addition, from 2014 to 2018 the average number of Top 10% highly-cited publications at TMDU was 201, a 14.9% in ratio, which is less than that of the benchmark large universities (Imperial College London: 3,137 publications at 26.6%). This decline in ratio is a global phenomenon due to an increase in the number of leading research institutions. In fact, the benchmark large-scale universities are also seeing a decreasing trend. We therefore aim to **double the number of Top 10% highly-cited publications by the end of FY2033** as an indicator of excellent publication results.

### 3. Develop Advanced Medical Dental Research Center: Creating a New Research Area to Increase Overall Research Capacity

We will launch a new research area based on medical data science. First, approximately 30 top data scientists will be assigned to the **M&D Data Science Center**, which opens in April 2020 (eight top researchers have already been recruited), to form **Japan's first medical data science research center encompassing medicine/dentistry and medical care from basic research to clinical research and development of drug and medical devices**. This center differs from other data science departments established at various universities in that it aims not only to carry out genomic data analysis, image analysis, and cohort analysis, but also to connect genomic data and other research data to high-quality medical data to examine life phenomena in health and disease. This center will compensate for the lack of a mathematics department at the university, and **in the next decade will develop into a strength in research at TMDU and social collaboration**.

This medical data science field will not only become a new distinctive priority research area but will also **develop innovative research based on multi-layered collaboration and data science integrated with the above-described priority research areas and become a driving force of our cutting-edge research**. In other words, it will form an advanced **medical and dental data science research center** unparalleled in the world.

In the field of intractable diseases, a research area in which we have been national leaders, we will build a multilayered data analysis and problem solving model by reinforcing collaboration with various leading institutes,



accumulating unique, high-quality, in-depth and distinctive basic research data and clinical data. To further facilitate this research, we will establish a medical data center, first of its kind in Japan as well as internationally, by establishing a pilot intelligent hospital by FY2028 and by cooperating with medical institutions in and around Tokyo. We will thereby create a platform that can store high quality and distinctive data which can be easily utilized for research and development purposes.

- Example case study of overseas benchmark universities for reference

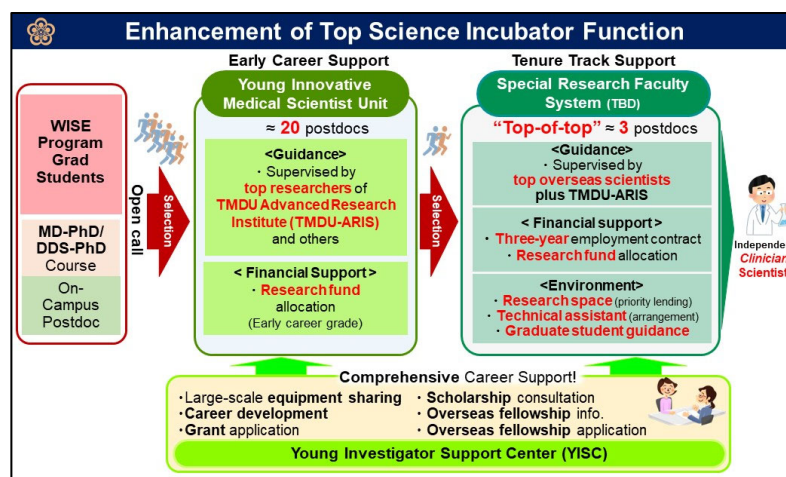
- Johns Hopkins University has a BioMedical Engineering Faculty and conducts undergraduate and graduate school education focused on developing the next generation of leaders. In 2016, the Malone Center for Engineering in Healthcare was established, working closely with the medical field to optimize health care and medical care by using advanced data analysis methods and machine learning.

#### 4. Enhancement of Top Science Incubator Function: Encouraging Young Researchers to Instigate Creative Research

It is essential, in the fields of mathematical and basic research, to allow young researchers up to their 30s to conduct innovative research stemming not from preceding research but from their own ideas. By the end of FY2033, we will select **50 young researchers who will flourish as outstanding university faculty members**, from among those who trained and studied in our top science incubator system.

To this end, we will strengthen the support system for acquiring research funding and writing scientific papers currently being conducted by the Young Innovative Medical Scientist Unit and the URA Office. This will be reorganized and renovated in the Institute of Research in FY2022. The new system, a **Young Investigator Support Center (YISC)**, will be established to

provide one-stop support for young researchers on campus, in areas such as advice on research, career development, grant application, scholarship consultation and so on. YISC will systematically collect information on overseas fellowships and support applications, and accelerate the adoption of international fellowships. Utilizing the President's discretionary expenses, it will expand the facilities for communal large-scale equipment and



**triple the amount of financial support for young researchers (currently 26,000,000 yen)**, thereby accelerating research by top young scientists. Furthermore, **three top-of-top researchers from the Young Innovative Medical Scientist Unit will be selected** and allocated research funds, given priority research space, and assigned technical assistants and advisors from not only the distinguished senior researchers at the TMDU Advanced Research Institute (TMDU-ARIS) but also from top overseas scientists who will join as dual supervisors to promote world-class research.

These top-of-top researchers will be employed for three years as a **special research faculty (TBD)** within the Institute of Research and progress up to be promoted to an independent PI by taking courses and advice on graduate student education and large-scale grant acquisition provided by YISC. After three years, this special research faculty (TBD) will be reviewed and those who show evidence in excellence will be given a **tenured faculty position**.

There is a need for physical study space for young researchers, graduate students, visiting researchers and data scientists to gather. The **Top Science Incubation Space (TBD)** will be set up in the Yushima and Surugadai campuses in FY2022 to create an environment where researchers can concentrate on research.

- Example case study of overseas benchmark universities for reference
- Imperial College London provides student supervision courses at the Lecture Teaching Centre and Human Resources (HR) for young researchers (lecturers). They also have a mentoring system in place. ICL sets measurable goals to be achieved for researchers in three years, and those who achieve them secure employment as PI.

**5. Promote Integrated Research Between Arts (Humanities) and Sciences (Inter-university Collaborative Research): Collaborations with Domestic Institutes and with Social Sciences**

To address domestic and international issues associated with health and diseases, we will establish **Interdisciplinary Research Collaboration** (TBD) in FY2024. Specifically, we will address ELSI (Ethical Legal Social Issues) issues associated with advanced science, data science, genomics and medical information, and to find solutions for increasing medical costs. To that end, we will utilize the framework of the Tokyo prefecture-led Startup Ecosystem Tokyo Consortium and collaborate with neighboring top-level national and private universities and the Union of Four Universities in Tokyo. We will conduct **research of key research areas, centering on flexible collaboration with individual universities** by strengthening cooperation with the Tokyo Institute of Technology in the fields of information engineering and quantum science & technology to introduce novel computer hardware and collaborate in the area of artificial intelligence. We will also collaborate with Faculty of Social Data Science (currently in preparation) at Hitotsubashi University for multi-dimensional analysis of data.

**[Talent Development / Acquisition]**

**(1) Fundamental Rationale**

**A. Current State and Self-Assessment**

◇ **Status of Developing Young Researchers in Undergraduate/Graduate/Postgraduate Education**

In medical and dental research, fundamental solutions for important issues obtained from front-line clinical situations are the most essential, hence there needs to be a long-term system that supports excellent research from clinical activities. In addition, in order to establish a Global Research and Education Center for Advanced Medical/Dental Data Science that contributes to the realization of “Total health care” at TMDU, we need to **build an undergraduate, graduate and postgraduate education system with a long-term perspective that can train excellent young medical/dental researchers (Clinician Scientists)** who can strongly pursue research in the areas of regenerative medicine, intractable disease and oral science, as well as future key research areas. However, the current undergraduate system is designed to provide mostly general training for healthcare professionals with many students going on to become doctors, dentists and other professionals after graduation. This is because the education model for *Clinician Scientist* has not yet been established. In order to continue producing top-level research results, it is necessary to devise ways to develop researchers from the undergraduate level. Notably, *Clinician Scientists* have led the world in biomedical sciences and made significant contributions in life sciences, health and medical care. Indeed, 37% of the Nobel Prizes for Physiology or Medicine, and many of the winners for Chemistry, have been awarded to *Clinician Scientists*. However, there is a worldwide trend in which the number of *Clinician Scientists* is decreasing due to the time it takes to nurture talent in this field, and the chronic lack of support and subsidies from both within and outside of the university organization (N Engl J Med 2019; 381:399-402.). Since this decline is a global concern, a successful solution to this problem can make our education system into a model case at a world-wide level.

Currently, our school has a researcher training system in place (Faculty of Medicine) for second- to sixth- year undergraduates with the aim of developing world-leading *Clinician Scientists*. There is still room for improvement for the young researcher development program to achieve excellence. In addition, it is important to develop advanced clinicians (*Scientific Clinicians*) who can connect advanced science to the world of medical practice. In the School of Medicine, we have developed not only researcher training programs, but also a Project Semester (≈6 months of free choice research engagement). It is necessary to continue our efforts to maintain, improve and

expand this training system.

◇ **Talent Development Contributing to Society 5.0 – Current State**

Reorganization of our graduate school in FY2018 allowed our students to learn preemptive medicine in an integrated manner and to develop talent who excel in clinical practice and research. A Medical Sciences Program for Preemptive Medicine was established in the Masters Program in the Graduate School of Medical and Dental Sciences and a doctoral program established an Integrative Biomedical Sciences Program for Preemptive Medicine. We launched an educational program on the integrated database of genomic information and electronic medical record information to learn about analyzing lifestyle and environmental factors through data mining. At the graduate level, we have begun developing talent that contribute to Society 5.0 in the medical field.

In addition, TMDU will establish an M&D Data Science Center in April 2020, aiming to advance next-generation medical dental research based on medical data. In order to **foster the next generation of medical data scientists**, we need **early elite education for undergraduates with high mathematical skills**.

A Doctoral program for Data-Related Innovation Expert was also adopted in 2017. It is a representative organization of the Consortium for Data Sciences in Medical Care and Drug Discovery, to train doctoral students and business people working in the medical and drug discovery fields. At present, the program is mainly aimed at doctoral students for the purpose of acquiring grants. Therefore, the program has yet to become a sustainable and specialized lifelong learning system (**Advanced Recurrent Education system**) for business people and medical professionals.

◇ **Talent Acquisition – Current State**

Under the program for promoting the enhancement of research universities, TMDU has adopted an international open recruitment tenure track system and strict term system operations. Through these efforts, we have worked to secure high-caliber talent both domestically and internationally to improve faculty agility. In addition, in 2017 we became the first university in Japan to establish a university-wide **Human Resources Committee** directly under the President to take on HR responsibilities on new and continuous recruitment and promotion of faculty staff, including professors. With this, a strategic President-led faculty personnel system was achieved. However, partly due to limitations in facility space, research support is one of the barriers to recruiting top domestic and international researchers. Therefore, improving research and living environments is a key challenge for us. In addition, since the ratio of foreign and female researchers/faculty members is low, we will need to **improve our efforts to promote inclusion and diversity in our staff community**.

**B. Initiative Direction**

◇ As a priority measure at TMDU, we will support research and education for excellent undergraduate, graduate, doctoral and postgraduate students who aspire to become **Clinician Scientists** by enhancing economic and employment support. With this **seamless and long-term education method**, we can cultivate students from the undergraduate level into becoming independent researchers (PI). We aim to become a role model for other Medical Research Universities with our sustainable development system of training **Clinician Scientists**.

◇ As we rapidly approach Society 5.0, we will conduct **medical data science education** from the undergraduate level while also strengthening graduate education, to develop talent with strong bioethics and a global perspective, who can analyze the wealth of medical and dental data possessed by the university to come up with solutions and make policy proposals, or to start their own business. In addition, among medical personnel who have already acquired national licenses, an Advanced Recurrent Education system will be established to develop talent that can make full use of medical data.

◇ For the acquisition of high-caliber talent from both domestic and international sources, we must strengthen the support systems for cutting-edge science, such as **improving the research and living environments for faculty staff and providing focused research support**. In addition, we will ensure that our top talent is able to focus on research by means of a flexible organizational structure that allows for **separation of research and**

teaching duties, and by offering various forms of employment, such as a tenure system, for talented researchers.

## (2) Initiatives in Detail

### 1. Establish a Medical Research University Talent Development Model: Creating an Outstanding Clinician-Scientist Training System

Successful *Clinician Scientist* development programs are rare in Japan. We will build a **seamless and long-term Clinician Scientist training system** from undergraduates to independent researchers (PI).

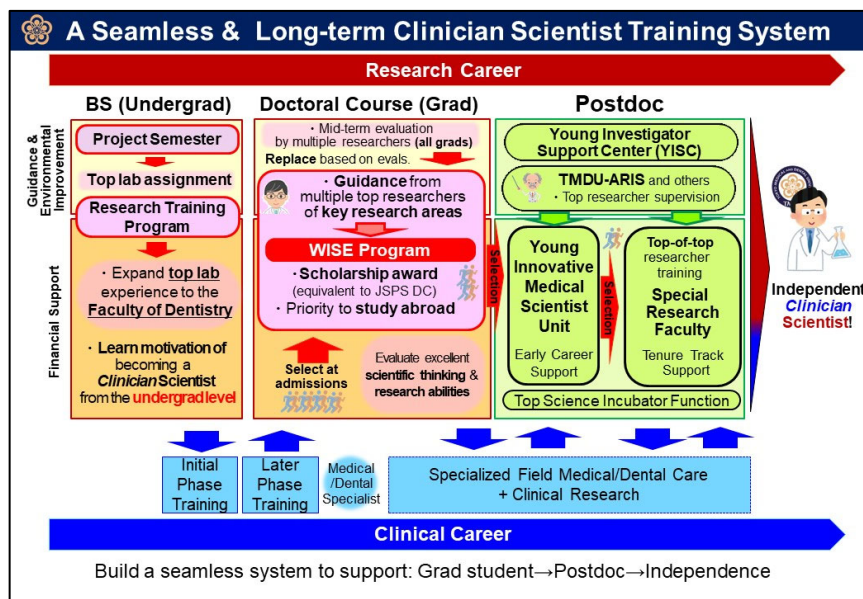
In undergraduate education, the research training program currently in operation at the Faculty of Medicine will be upgraded and expanded to the Faculty of Dentistry, with the goal of exposing students to world-

leading research at top laboratories. In the Project Semester, there will be further opportunities to experience world-leading research in top laboratories in Japan and overseas. Through these experiences, students will learn the significance and motivation of becoming a *Clinician Scientist* from the undergraduate level.

In graduate education, we aim to create a competitive environment with students from other universities and top medical professionals who have completed clinical training. We will introduce a **WISE Program (Doctoral Program for World-Learning Innovative & Smart Education)** (≤10 students / year) in which a scholarship (200,000 yen / month) will be awarded to selected outstanding graduate students. They will also be given priority to study abroad, as well as an environment that allows them to focus on developing their research. First, we will establish the framework for graduate school excellence at the admission selection stage. Students wishing to enroll will receive advice from faculty members, for example on key research areas of TMDU and submit research plan documents enabling us to identify candidates with excellent scientific thinking and research abilities, who will then be selected as an outstanding graduate student. For these outstanding graduate students, a Guidance system of faculty supervisors and multiple researchers (PIs) will be established to provide advice and focused research guidance in key research areas from top scientists from Japan and overseas. In addition, a mid-term evaluation will be conducted for all graduate students to advise them on the direction of their research. Some outstanding graduate students may be replaced subject to the results of the intermediate evaluation. They will also be given the opportunity to engage in specialized medical care as a Clinical Assistant (CA) at our affiliated hospitals and paid a salary, even during their research period. Through this system, they will be able to continue their clinical career while acquiring the basic research skills necessary to become outstanding *Clinician Scientists*.

**Post-graduation Clinician Scientist** development will entail the system described in “Strengthen Research Capability (2) 4”, which provides a fulfilling research environment, research support by YISC, research advice, economic support, grant acquisition support, and career development consultations to foster and produce independent top PIs under this preferential environment.

The training of Clinicians with a high level of scientific thinking (*Scientific Clinician*) will continue beyond graduation; the research training program’s capacity will be increased with students assigned to top labs in Project Semester, and opportunities for long-term contact with researchers will be provided such as via a collaborative forum with post-graduate *Clinician Scientists* and data scientists to ensure that our *Scientific Clinicians* are



equipped with the latest knowledge and skills in order to excel at the forefront of social implementation. *Clinician Scientists* and *Scientific Clinicians* will thus become dual wheels in a system that creates positive impact on society.

## **2. Social Contribution to Society 5.0: Training the World's Leading Medical Data Scientists**

Establishment of the M&D Data Science Center will enhance the research development, creative research capabilities and cultivation of *Clinician Scientists* at our university. To this end, we will introduce new initiatives in three stages: undergraduate course, graduate school and post-graduation (recurrent education).

First, in FY2022, we will **enhance the data science education of the existing graduate master's course Medical Sciences Program for Preemptive Medicine and the doctoral course Integrative Biomedical Sciences Programs for Preemptive Medicine**, utilizing the framework of the Startup Ecosystem Tokyo Consortium under the main leadership of Tokyo Metropolitan Government. By implementing this entrepreneurial training, we will train global medical professionals, medical and dental researchers and entrepreneurs with basic skills in medical data science.

Moreover, with the ultimate goal of developing medical data science leaders and entrepreneurs (Clinician Data Scientists), we will **refine students' mathematics skills, provide top medical data science, introduce the education of advanced medical data science and entrepreneurship to all undergraduate students** during their years of formative learning. Specifically, the curriculum of mathematics and entrepreneur training will be strengthened by faculty members of the M&D Data Science Center.

Furthermore, to provide **elite medical data scientist education from an early stage**, we will consider various forms of learning and, based on the progress of education and research at the graduate school mentioned above, new faculties/departments will be established to teach selected groups of elite students. We hope this will help develop talent with a strong sense of bioethics and global perspective, who have outstanding data science skills, can propose solutions and policies for various medical and healthcare issues, and can create new value in the health tech field.

In addition, in the area of **ELSI (Ethical Legal Social Issues)**, which is essential for advanced sciences, we will enhance the humanities and social sciences education in collaboration with nearby top national and private universities and the Union of Four Universities in Tokyo.

Regarding recurrent education, in FY2022 the current Doctoral program for Data-Related Innovation Expert will be enhanced as a lifelong learning (**Advanced Recurrent Education**) system, specializing in data science for medical professionals. We will search for solutions to medical problems and develop talent who can expertly handle data in the field of medical and dental science and contribute widely to Society 5.0.

## **3. Recruit Excellent Domestic/International Students/Faculty Members: Improving Educational/Research Environment**

The university has established, under the leadership of the President, a **Personnel Committee** for strategic recruitment of faculty members. Based on the current and projected needs, this committee and its related selection committees have the enhanced power to promote faculty affairs in the research and medical data science fields, our areas of strength, by offering bold career progression options to faculty members. An education research university like TMDU requires flexible staffing strategy. We will encourage the recruitment of top domestic and international researchers by promoting **early separation of research and teaching duties**, utilizing **cross-appointment** and other systems.

A robust performance review system is essential to attract diverse talent. At TMDU, the Institute of Information Technology already operates a **University Information Linkage System**, which offers appropriate salary incentives based on faculty performance review. Furthermore, we will introduce a comprehensive and flexible evaluation and support system, such as a **tenure system for high-performing researchers** and preferential treatment in their research environment.

At the student level, we take full advantage of our geographical proximity to high schools in the area, and

University-High School Collaborations, to operate a priority selection system with these schools. WISE Program graduate students are evaluated regularly and offered YISC and other support at various stages, as well as potential employment as a special research faculty member (TBD).

For these outstanding domestic and international researchers, cross-appointed faculty members and WISE Program graduate students, we will install a Top Science Incubation Space to **improve their education and research environment** (including enhancements to communal research equipment), **and to provide a better living space** as well as various other incentives. In addition, we aim to diversify human resources by accelerating various initiatives, such as establishing a tailored pay and benefits system to increase employment of foreign and female researchers, offering childcare support and research support assistants for female researchers facing life events and establishing remote research collaboration systems using ultra-high speed communications.

- Example case study of overseas benchmark universities for reference
  - Harvard University has enhanced financial subsidies, such as tuition waivers and scholarships, for MD-PhD or DDS-PhD courses in order to train **Clinician Scientists** (research doctors) and have successfully recruited superior students to those in the usual MD or DDS course.

## [Advance International Collaboration]

### (1) Fundamental Rationale

#### A. Current State and Self-Assessment

##### ◇ International Collaboration with Overseas Partner Schools – Current State

TMDU has been promoting overseas exchange with a large number of universities. Our partner schools, including Harvard University, have now extended to 107. In terms of education, Medical School undergraduate students study abroad for three to six months at top universities in Europe and the United States (e.g. Imperial College London and Harvard University) in their fourth-year Project Semester, and at Harvard University-affiliated hospitals for clinical practice in their sixth year. Dental School students carry out research at overseas partner schools, again including Harvard University, for about three months in their fourth year.

We have also established overseas bases in Chile, Ghana and Thailand. In particular, at Chile University, Chulalongkorn University and Mahidol University, we have established joint degree programs (doctoral programs) to promote research and education collaboration. In FY2013, the Health Sciences Leadership Program (HSLP) was established as a special course for medical and dental students in an effort to develop global talent from the early stages of undergraduate school. In addition, in 2018, a Master of Public Health in Global Health Course was established in the Master's Program to develop global talent who can make immediate contributions at international organizations such as WHO. Thus we support our graduates to contribute to and achieve success in their global careers.

Although we have a good track record of mutual achievement in our undergraduate and graduate students visiting and interacting with other universities, **there have not been as many opportunities for young and senior faculty members to collaborate with overseas researchers**, for example there are no subsidies for medium- to long-term stays abroad. In addition, although individual researchers at TMDU collaborate with the world's top laboratories, the level of such international collaboration vary between research areas. Indeed, the three key research consortia of life-course research have only recently begun to collaborate across different subject fields themselves. There is room for improvement in establishing a close education and research system with top universities since the extent of collaboration with these institutions also vary, and we feel the time has come to focus on quality over quantity of our relationships with them. In addition, since **we have not been able to acquire talented young researchers or renowned researchers from overseas**, there are not many foreign faculty members at TMDU. Our faculty is still in the process of globalization. A key barrier to acquiring international talent is the fact that the Japanese national medical and qualification examinations and specialist examinations are conducted in Japanese, forcing undergraduate and postgraduate education to be conducted in Japanese. This makes it difficult

to hire foreign faculty staff for departments closely related to clinical work, since they do not have a Japanese physician/dentist license. It is also partly due to inadequate housing facilities for researchers from overseas. These factors may have led to TMDU's lack of international recognition, and may explain the low ratio of international co-authored papers. There is room for improvement in this area.

Aside from this, we have started expanding international collaboration in the field of data science; for example we started Datathon-Japan (held for the first time in Japan in FY2017), a unique international symposium organized by TMDU. Medical personnel, such as doctors and nurses, along with data scientists and statisticians worked with AI and machine learning researchers from universities and businesses to analyze big data accumulated from medical care (intensive care) in collaboration with experts from other fields. This initiative aims to contribute to the construction of evidence-based medicine (EBM) utilizing the statistical knowledge obtained through this collaboration. Significantly, Massachusetts Institute of Technology, one of the top universities in this field, The National University of Singapore and the global company Google collaborated with us on this project. Elsewhere, there is still scope for improvement in other fields such as intensive care.

#### ◇ **International Expansion of TMDU's Educational Research Content – Current State**

Faculty of Dentistry is expanding its dental professional education to the world through its promotion project, including a project to promote Dental Education and Research Bases in Southeast Asia, which was implemented between 2012 and 2015. At present, dentists from mainly Southeast Asia are invited through the International Faculty Development Course (IFDC), who subsequently promote the benefits of our education system overseas upon completion of the course. However, we don't currently have **a structured program in place to provide clinical training/education to overseas physicians and dentists**; only a small number of them visit TMDU as a result. Again, there is room for improvement and further expansion.

#### **B. Initiative Direction**

- ◇ We will activate international collaboration at each level, from lab/subject field to university. We will identify priority overseas collaboration facilities for each level and conduct substantial joint research. At university level, we will increase the number of partner schools as appropriate and strengthen existing ties with overseas universities to **establish partner universities as hubs**. Based on these initiatives, we will hold a unique international symposium to encourage international collaboration activities and obtain external overseas funding through them.
- ◇ Provide **support for short- and long-term stays for staff at important educational research centers to facilitate** face-to-face discussion between researchers and faculty staff to promote substantial research.
- ◇ Establish a base for doctors and dentists from overseas to **conduct clinical training** at TMDU.

#### **(2) Initiatives in Detail**

##### **1. Collaborate with International Universities at Lab/Subject Field/Research Area/University Levels**

We will expand the number of international joint research institutions that practice top-level research. We will also set up overseas advisors and collaborative research institutes, and organize research meetings and international symposia in collaboration with domestic and international academic societies in our key research areas including Organ and Tissue Neogenesis / Organoid (mini-organ) Research, Rare and Intractable Diseases Research, and Hard Tissue / Oral Science Research. In the field of medical data science, we will extend international collaboration at various levels, such as expanding the data collection area by means of the previously mentioned Datathon-Japan. In addition, with the aim to build substantial collaboration for global expansion, we **will have established agreements on educational and research collaboration systems with more than 10 top universities in the world (overseas hub universities) on all five continents** by the end of FY2033. For further development, we will build organic collaboration with branch universities based on hub overseas universities. In addition, in order to address issues in medicine/dentistry and data science, we will actively recruit top researchers at partner schools

and other institutions by cross-appointment and other measures. As for research environment and housing measures for inviting faculty members and graduate students from overseas, making effective use of the existing campus, we will utilize the Top Science Incubation Space mentioned above in [Talent Development / Acquisition] and set up **dormitories for overseas faculty members and graduate students (Student Village)**.

Through such initiatives, we will obtain external funding from the National Institutes of Health (NIH) and the Human Frontier Science Program (HFSP) for **overseas grant applications**, together with overseas collaborators at top universities. We expect that the acquisition of these overseas research funds will not only strengthen international joint research but also our financial position.

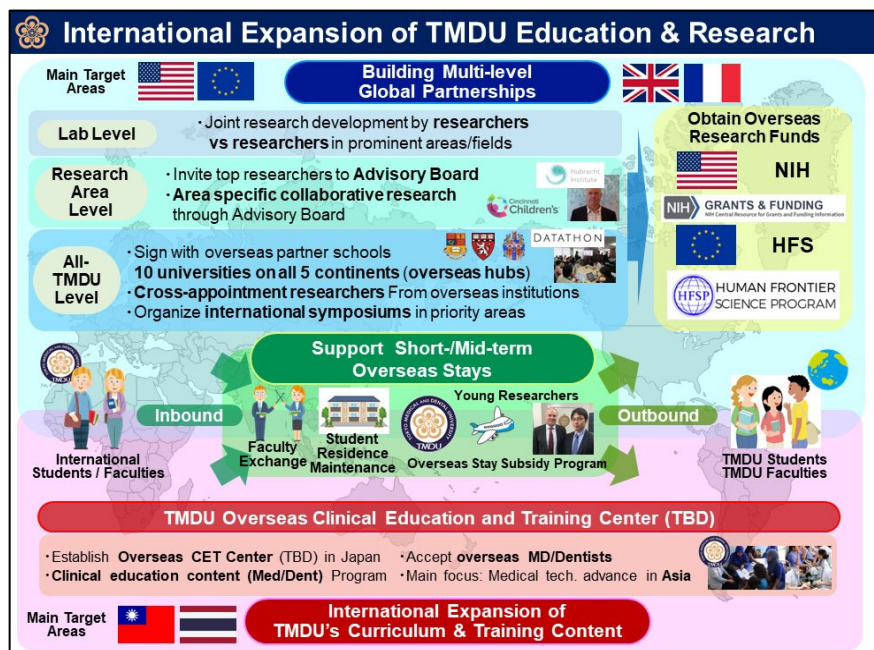
- Example case study of overseas benchmark universities for reference
  - Johns Hopkins University has established international bases (educational and research institutions and hospitals) to increase international collaboration.

## 2. Support Short-/Medium-term Stays by Researchers at Overseas Educational and Research Bases

Even in the high-speed Internet age of today, face-to-face discussions and research collaborations shared in the same physical space and time remain extremely important. We will establish a system for researchers to visit overseas universities for short- and medium-term periods for the purpose of substantial overseas collaboration and raising TMDU's international profile. Specifically, a **short- to medium-term Overseas Stay Subsidy Program for young researchers** ( $\leq 10$ /year) will be launched to promote exchange and joint research with foreign researchers. In addition, starting with partner schools, international communication will be strengthened by increasing opportunities for exchange visits by PIs. Such pragmatic collaboration will increase the number of overseas researchers with an established relationship of trust with TMDU, the ratio of international co-authored papers, and gain international recognition for the TMDU, with the ultimate goal of improving our world ranking.

## 3. International Expansion Using TMDU's Curriculum and Training Content

As part of TMDU's international contributions particularly in the Asian region, we will **build a system to provide our education and training content overseas**. Specifically, in addition to the clinical education system developed and practiced by the Faculty of Dentistry, we will translate the clinical medical education system for Japanese educational and training programs into English for overseas doctors



and dentists. We will set up a **TMDU Overseas Clinical Education and Training Center (TBD)** to provide training to a wide range of overseas doctors and dentists. To this end, in FY2024, we will set up a non-profit organization dedicated to this project which will coordinate admissions and logistics.

- Example case study of overseas benchmark universities for reference
  - Harvard University has been very active in international education collaboration activities. They have expanded their educational program globally by establishing the excellent educational content system of Partners Harvard Medical International, and by inviting faculty staff from overseas universities around the world.



## [Enhanced Governance]

### (1) Fundamental Rationale

#### A. Current State and Self-Assessment

- ◇ Under the President's strong leadership, TMDU has gradually introduced an **Integrated Organizational System** from the end of FY2015. This system is in place to manage and support various university operations (university innovation, research, education, hospital administration, global affairs, information technology) from a university-wide and integrated perspective. Also in FY2015, as a mechanism to support the President's decision-making, we introduced a University Information Linkage System which accumulates comprehensive data by integrating various quantitative data previously managed by respective individual sections, into a single, centralized system. In FY2019, we established an IR Office under the direct control of the President and have recently started analyzing and utilizing the accumulated data. However, as demand grows for **new projects/activities to meet the needs of society, it is becoming increasingly difficult for the President alone to make decisions with comprehensive awareness and knowledge of every TMDU activity.**
- ◇ The President's Advisory Board, comprising of junior professors, and the President's Strategic Policy Section, comprising of administrative staff, collaborate with faculties to consider future strategies for university research, education, and health care from a university-wide perspective, and work together to bring various plans to life. However, they comprise of only internal faculty members within the university, and ideally require input and feedback from **experts in humanities and social sciences** in order to effectively contribute to Society 5.0.
- ◇ Of note is the personnel payroll management system. The **Personnel Committee** was established in FY2017, consisting of the President and directors, to increase transparency of personnel management and recruit faculty members in line with university-wide strategy. In particular, selection of professors is the key to improving the quality of research, education, and medical care. In this regard, the Professor Selection Committee, which was previously directly under the faculty council of each department, was re-positioned to sit under the Personnel Committee. This Selection Committee includes external experts from outside the university as well as faculties from other departments within the university. We also operate a system to directly link performance review results (relative evaluation) to bonuses (for diligence allowances) and salary raises in reference to the quantitative data found in the University Information Linkage System. However, salary increase is capped at an upper age limit set for all faculty positions, thus creating a culture whereby pay and reward are not based purely on seniority or years of service.
- ◇ Compared to other national university corporations, TMDU has unique advantages of being a Small University, such as its agility and a governance system that enables the President to easily demonstrate leadership. While making full use of such advantages, we must put the current system under constant review in the spirit of continuous improvement and to further strengthen our management capability.

#### B. Initiative Direction

- ◇ Further strengthen our governance system to make prompt and appropriate policy decisions in response to constantly changing social demands, informed by comprehensive and strategic vision, and to implement key projects consistently.
- ◇ Ensure corporate accountability and transparency through faithful implementation of internal and third party quality assurance evaluation.

### (2) Initiatives in Detail

#### 1. Strengthen Integrated Institutes (Establishment of Institute of Innovation Promotion (TBD), Clarification of Roles/Authorities/Responsibilities)

The **Institute of Innovation promotion** (TBD) will be established to supervise private capital acquisition. The institute will incorporate the knowledge of commercial front-line experts, including external directors, to initiate

further efforts for stabilizing our financial position.

In order to make prompt and appropriate policy decisions on increasing number of new projects, **the roles, responsibilities and accountabilities of the directors of each integrated organization (executive director and vice president) will be clarified to enable them to demonstrate maximum leadership in each project.** Specifically, the President and executive directors will examine and decide the basic policies at the board of executive directors' meeting. Based on these policies and authority delegated by the President, each integrated organization's director will then: 1) provide advice and coordinate the department management in line with the basic policy, 2) identify department-specific issues, have them examined by the President and directors and incorporate them into the basic policy as necessary, and 3) manage the progress of the overall plan. When deciding on a basic policy, we will **strengthen the staff and functions of the IR Office** in order to plan organizational reform based on our own institutional objective data collection. Department managers shall be given discretionary power over personnel and budget in line with the basic policy, ensuring a certain degree of autonomy in each department, and be obliged to manage and report the progress of department-level plans.

In order to respond to diversifying social requirements, we will have external management personnel with high expertise and insight in management strategy and organizational management, as well as top overseas university professors, involved in university reform and international expansion as directors. These external directors will be involved not only in discussions and giving advice, but also in the management, planning and international development of the university, and will participate closely in steering the university's operation.

- Example Case Study of overseas benchmark universities for reference
  - The governance of Imperial College London is based on an ideal hierarchical structure of President-provost-dean, with clear roles and responsibilities.

## **2. Build an Advanced Advisory Board (Develop Integrated Intelligence Council to Examine the Future Direction of the University/Develop Next-Generation Talent)**

To become an independent national university and contribute to the global/domestic society in an on-going basis, it is necessary to train the next generation of faculty members capable of making future plans, gathering wisdom not only from medicine and dentistry but from a wide range of fields, and engaging in out-of-the-box discussions on topics such as the future direction of the university. To this end, we will develop and reform the current **President's Advisory Board to become a new Advanced Advisory Board that includes young opinion leaders in the department, experts in humanities and social sciences and external experts.** The Board will meet regularly, including the President, to consider the university from a comprehensive perspective that transcends medical and dental subject fields, and be involved in drafting future plans, structural reforms, strategy-building and making recommendations for university reform.

## **3. Internal QA, Information Disclosure and International Publicity to Ensure Integrity and Transparency of TMDU Governance**

As an internal quality assurance system for various activities of TMDU, we will introduce a system to set appropriate key objectives for major projects against which project outputs/outcomes can be measured. The **system will be used to measure the performance and effectiveness of each major project,** in combination with internal IR data. In particular, with regard to research projects, an **Integrated Research Evaluation Meeting (TBD)** will be established comprising of internal and external top researchers from across Japan and abroad, to conduct evaluations that incorporate international perspectives.

Thoroughly disclose and provide information on education, research and finance as a designated national university supported by the Japanese public. Specifically, an **integrated report** will be issued. We will also promote an English language version of our website to increase international recognition and proactively disseminate international information by, for example, **quadrupling the amount of press releases of TMDU research results to**

the international community.

**[Social Collaboration: Development of Close and Interactive Collaborations with Industry, Government Agency, Academic and Private Partners]**

**(1) Fundamental Rationale**

**A. Current State and Self-Assessment**

- ◇ TMDU has been working to build an active industry-academia collaboration promotion system. With the support of the MEXT's project, the **Institute of Open Innovation** has been in operation since FY2018. Through this, we already have a good track record of: (a) successful large-scale industry-academia partnership agreement at the organizational level under the TMDU Open Innovation System (5 companies, totaling 580 million yen); (b) steady increase in industry-TMDU joint research funding (FY2016, 440 million yen → FY2018, 720 million yen); (c) stable income from patent and license revenue (FY2016-2018, total 500 million yen); (d) establishing innovative venture companies in the healthcare industry (FY2013-2016, 5 companies); (e) integrating and leading practical applications of innovative technologies/ideas in the medical/healthcare community through the operation of nationwide Med-U net organization; (f) establishing and organizing the University Research Administrator (URA) model.
- ◇ Supported by the Cabinet Office's Program for Enhancing an Environment of National Universities for Creating Innovation in FY 2019, TMDU has established a Private Funding Promotion Headquarters as a flagship organization to further increase income from the private sector. To date, it has contributed to further accelerate our efforts in this area.
- ◇ Besides industry-academia collaboration, one of our key challenges is the **development of an organization that oversees the acquisition of donations and the effective utilization of assets through efficient management of specialist departments/personnel and inter-sectional collaboration between research, education, medical care and public relations departments**. Through the establishment and operation of a new supervising organization, we must strengthen **collaboration with a broad range of particularly non-medical industries**, in light of forthcoming social changes led by technical innovations in areas such as data science. It is one of our university's key missions to tackle social problems by further promoting development of innovative start-up companies in the medical/healthcare area.
- ◇ In cooperation with the Tokyo Metropolitan Government, we are implementing a number of joint projects in regional healthcare policy, including: (a) Tokyo Project for Child Health Care (planned for FY2019-2021, 160 million yen); (b) launch a course on community medicine with Tokyo Metropolitan Government (planned for FY2019-2020, 40 million yen); (c) conclusion of inter-institutional device-sharing agreements for the promotion of open innovation in drug discovery and in medical research (started in FY2019, partial financial support by the Tokyo Metropolitan Government). We are currently promoting collaboration with the MEXT, the Ministry of Health, Labor and Welfare (MHLW), the Ministry of Economy, Trade and Industry (METI) and others through various measures and personnel exchanges. However, **further long-term initiatives are required for TMDU to be able to influence and make recommendations to the formulation of national healthcare policies**.

**B. Initiative Direction**

- ◇ By capitalizing on our strengths in research, education, and medical care, we will develop and operate a new, on-campus organization that will lead various pioneering activities through interactive cross-disciplinary collaborations with industry, government agency, academic and private partners. We will thus cultivate broad and tight-knit collaborative relationships with industries including non-medical areas, as well as with local governments, to establish a system that can respond flexibly to future healthcare problems in global society.
- ◇ A new platform of creative collaboration will be established to symbolize the collaborative relationship between industry, academia, government agency and private partners. Through the establishment of this new platform,

we will bring together innovative ideas and talented researchers to promptly identify the most pressing problems in the medical field and find the best solutions for those problems. Based on these activities, TMDU will extend and enhance its global reputation, representing Japan as a national flagship of medical innovation.

## **(2) Initiatives in Detail**

### **1. Establishment of Institute of Innovation Promotion (TBD) (repost)**

The **Institute of Innovation promotion** (TBD) will be newly established in FY2023 to reorganize and integrate the departments that have been independently involved in fundraising and fund operation: the TMDU Fund, the Open Innovation Institute and the Private Funding Promotion Headquarters. The new institution will play a leading role in promoting private funding as well as collaborations with a broad range of medical and non-medical industries, government agencies such as METI, and various overseas companies to perform joint ventures. The director (executive director) will share TMDU's fund management and investment strategies with the President, board of directors and administrative council, and based on this, he/she will supervise and implement individual strategies on industry-academia collaboration, open innovation, raising of private funds and support for business start-ups. Through these activities, we will **increase our private funding income by 1 billion yen to a total of 2.7 billion yen by the end of FY2033.**

- Example case study of overseas benchmark universities for reference
  - At Imperial College London, 38 experts are assigned under the direction of the vice-provost, who is in charge of an industry-academia collaboration department. Under this system, an independent team of 10 specialists are in charge of corporate partnership and works to provide close support for academic-industry collaborations by maintaining regular contact points for researchers in each department.

### **2. Establishment of a New Collaborative Workspace for Industry, Academia, Government Agency, and Private Partners**

TMDU's Yushima Campus is situated close to Ochanomizu station and easily accessible from the Tokyo Station, Haneda International Airport, and Narita International Airport. TMDU is therefore ideally located to be a spontaneous hub for talented people and information to gather, making it an attractive platform for start-ups and venture businesses. Taking full advantage of our optimal location, and to pursue TMDU's role as the national flagship of medical innovation, we will **establish and provide a new creative workspace where our industry, academia, government agency and private partners can gather together and collaborate organically across various fields.** By sharing the collaborative space with talented people in businesses, local governments or with patients and the general public, researchers in medical science, dental science, technology science and medical data science can: 1) share and gain awareness of essential social problems in the healthcare field; 2) establish strategies to solve these social problems based on TMDU's original basic research findings or innovative healthcare technologies/ideas, leading to prompt implementation of those solutions by cross-disciplinary collaboration with industry, government agency, academic and private TMDU partners. The new space will therefore function as an interactive collaboration platform for all TMDU researchers.

### **3. Local Governments/Ministries**

We will increase the number, scale, and sustainability of joint projects with local governments, including the Tokyo Metropolitan Government. Tokyo Metropolitan Area is a gateway to Japan for the global community and the center of national politics and economic activities. We will lead national healthcare policies in a rapidly aging, data-driven society (Society 5.0) through multiple joint projects with local governments and/or public hospitals in the Tokyo Metropolitan Area, while playing a key role in communicating advanced initiatives to the global community. Based on TMDU's prime location and high-quality medical care skills, we will accelerate personnel exchanges with government ministries to further establish close collaborations, and thereby engage in dissemination of new

standards/recommendations to the domestic and international healthcare community.

**[Strengthen Financial Position]**

**(1) Fundamental Rationale**

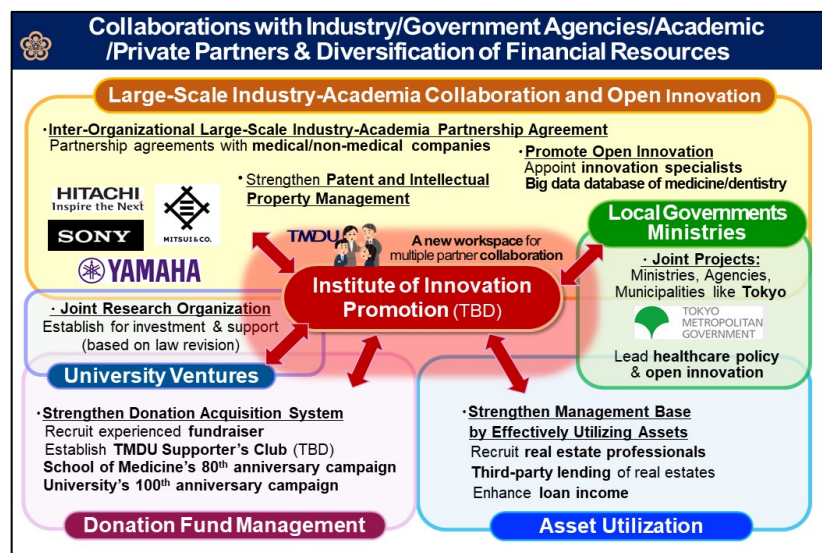
**A. Current State and Self-Assessment**

- ◇ Government-aided university grants are being continuously reduced in light of Japan’s economic difficulties. We therefore need to **reinforce our own financial position** independent of tax-based university grants.
- ◇ In FY2011, a fundraising division was set up in an effort to raise more donations, and in FY2019 full-time faculty staff were assigned as fund raisers to seek philanthropic investment, such as from the Tokyo Medical and Dental University Fund. There is still **room for improvement** in the system.
- ◇ TMDU makes the most of its prime location close to Ochanomizu station by promoting the effective use of its assets. Due to a revision in the National University Corporation Law, it has recently become possible to lend real estate to third parties. With approval from the Minister of MEXT, we have already signed two real estate lease agreements (this is the first case of long-term real estate lease approval for a national university).

**B. Initiative Direction**

- ◇ As a designated national university, TMDU will pursue diversification of financial resources to establish a robust financial base that is required for the sustainable and remarkable development of education and research.

- ◇ The Institute of Innovation Promotion (TBD), a new organization that will be developed and reorganized from the existing Private Funding Promotion Headquarters, will play a central role in diversifying



financial resources. This institute will work organically with the IR office and lead the acquisition of private donations through information gathering/analysis and strategic planning. These activities promote industry-academia and academia-government collaboration, donations and asset management based on the attraction of TMDU campuses’ prime location, leading to an increase in the overall income from private funding, in addition to national funding.

**(2) Initiatives in Detail**

The operation of this initiative requires considerable investment and is not feasible without reliable financial resources. Specifically, expected costs come to about 600 million yen (average) for each fiscal year during the fourth mid-term target period. Financial resources allocated to this initiative, include several projects listed below, all currently in development and demonstrating good potential. In addition, other financial resources being prepared to secure this initiative are: (1) additional property loan income (220 million yen: contracted); (2) increase in tuition fees (160 million yen: to be implemented from FY2020) (3) the President's discretionary expenses (approx. 500 million yen). All of the above are fully approved and every effort has been made to ensure the smooth implementation of the initiative.

### **1. Increase the Size of TMDU Donation Fund by Strengthening the Donation Acquisition System**

We will reorganize individual departments that have previously handled donations and integrate them into the Institute of Innovation Promotion (TBD). The new institute will supervise and implement a reinforced fundraising program, and thereby increase donations dedicated to TMDU and TMDU hospitals. The fundraising scale will be **increased from 280 million yen (total) to 2.4 billion yen (total) by the end of FY2033, a nine-fold increase.**

Specifically, (1) a fundraising support association (**TMDU Supporters Club (TBD)**) will be established as the organization to promote fundraising activities. This organization will conduct fundraising and public relations activities aiming to expand the TMDU donation fund in cooperation with the TMDU Alumni Association. Members will include not only TMDU graduates but also prominent stakeholders of TMDU, including patients of the TMDU hospital and potential donors. In addition, (2) A special **fundraising campaign will be launched** for the 80<sup>th</sup> anniversary of TMDU Medical School in FY2024 and for the 100<sup>th</sup> anniversary of TMDU (School of Dentistry) in FY2028, as well as (3) **Crowdfunding** and (4) **Charity naming rights** to promote and further expand the TMDU donation fund. In order to secure the operation of these activities, we have already recruited the former director of the fundraising section at Hitotsubashi University. During his career at Hitotsubashi University, he successfully doubled the total donation amount for the university from 5.5 billion yen (February 2013) to 11 billion yen (March 2019).

### **2. Strengthen Management Base by Effectively Utilizing Assets**

With the approval of the MEXT, we have already utilized a fixed-term lease scheme to loan real estate for the former dormitory and lodging sites. Making the most of the attractive location of TMDU campuses, we will further accelerate the effective use of all assets held by TMDU and enhance loan income from the private sector. We have already hired specialist Sumitomo Corporation real estate professionals to handle these activities.

### **3. Develop Business in the Rapidly Growing Data Business Field**

TMDU will build a multi-layered big data database in our specialty fields of medicine and dentistry, organizing data and increasing their value. We will **establish a new data business** by the end of FY2028 based on our original database and develop it as an alternative financial resource.

### **4. Develop University-originated Venture Companies**

TMDU will realize self-sustainable management by establishing a joint research organization (subject to legal development) or a medical consulting company. Based on the income from these activities, we will invest in university ventures, with a goal of **increasing the number of TMDU-originated ventures from the current 5 to 50 by the end of FY2033, a 10-fold increase.** (Investment activities for university-originated venture companies are subject to the revision of the National University Corporation Law)

### **The Next Decade and Beyond**

All members of TMDU have been discussing our future vision and necessary reform since 2016 to aim for further heights. This report summarizes our intent and determination to form a global research and education center for advanced medicine and data science by further evolving that vision and formulating specific plans to make them a reality. By the end of FY2033, TMDU will become one of the world's top medical research universities, contributing to "Total health care" in society and serving as a global role model in medical and data science research. We will evolve continuously to become a university that contributes to solving both domestic and global issues through enduring research excellence.