



Special Feature

# Cultivating Tomorrow's Researchers

Japan suffers from a shortage of people going into basic medical research despite its world-class medicine. To help address this issue, Tokyo Medical and Dental University (TMDU) has developed programs for students ranging from second-year undergraduates to those pursuing doctorates, in order to cultivate future researchers. In this feature, we introduce some of our students and their research experience at TMDU.

## • Overview of Programs

# Seamless research environment to cultivate Future medical researchers

### School of Medicine courses:

#### Research experience from Year 2

TMDU offers medical undergraduates four possible degree routes involving medical research.

The Research Training Program is offered to students during a five-year period, from Year 2 to Year 6. A Project Semester (PS) is mandatory during Year 4. The Physician Scientist Program starts in Year 5. Students can also opt to do the three-year MD-PhD Program before starting their Year 5 clinical clerkship.



Prof. Hiroshi Asahara  
(Chair, PS Committee; Head, Working Group Overseeing Research Training and Physician Scientist Programs, School of Medicine, Faculty of Medicine)

Unique to TMDU, the Research Training Program gives undergraduates credited medical research experience as early as their second year. Students join one of 15 research laboratories to conduct research outside regular class hours, and make poster presentations on their results at the academic year-end.

Professor Hiroshi Asahara says the program offers benefits beyond the actual research experience.

“In the old days, medical students were often enthusiastic about taking up research at a lab even if it was not mandatory but there are few such students nowadays. We created the Research Training Program to give students more structured support for actual research. It generates spontaneous learning opportunities and also cultivates skills such as team-building that prove valuable in later studies and clinical clerkship.”

### Two programs for future researchers

TMDU offers the Physician Scientist Program and the MD-PhD Program as alternative pathways for students who aspire to be fully fledged medical researchers after having completed the Research Training Program. Both enable medical students to conduct research from as early as Year 5, but differ in the way the research is combined with other studies.

In the Physician Scientist Program, students are assigned to conduct lab-based research outside of regular class hours while still continuing their Year 5 & 6 clinical clerkships. Next they study for a PhD in graduate school before continuing research as an assis-



Prof. Sachiko Iseki  
(Research Project Module Coordinator)

tant professor.

Under the MD-PhD Program or DDS-PhD Program, students first obtain a PhD before starting a clinical clerkship. The three-year PhD program starts after completion of Year 4, following which students return to the Year 5 clinical clerkship path. It is also possible to continue research by combining elements of the MD-PhD Program with the Physician Scientist Program.

In addition to these programs, the School of Medicine offers a Project Semester (PS) as a five-month course during the second half of Year 4. The compulsory PS course aims to imbue students with the necessary scientific perspective for both basic research and the clinical field.

Many students use the PS opportunity to study at one of TMDU's overseas affiliated institutions such as Imperial

College London or Chulalongkorn University in Thailand.

Prof. Asahara elaborates, “What kind of research you do or will do is a critical consideration in the careers of many Western researchers. Research experience can directly affect your future medical career. Gaining good medical research experience as an undergraduate is valuable even if your ultimate goal is to be a physician”.

### School of Dentistry courses: Research Project in Year 4

The School of Dentistry offers hands-on research to students to foster the development of research dentists. Analogous to a Project Semester, the mandatory 7-week Research Project in Year 4 starts in June and can be extended into the August summer vacation. It can be done at an overseas affiliated institution. Non-dentistry placements within the School of Medicine or at other Japanese research institutions are alternative possibilities.

Introductions and placement preparations begin from February in Year 3 to maximize the benefits of the Research

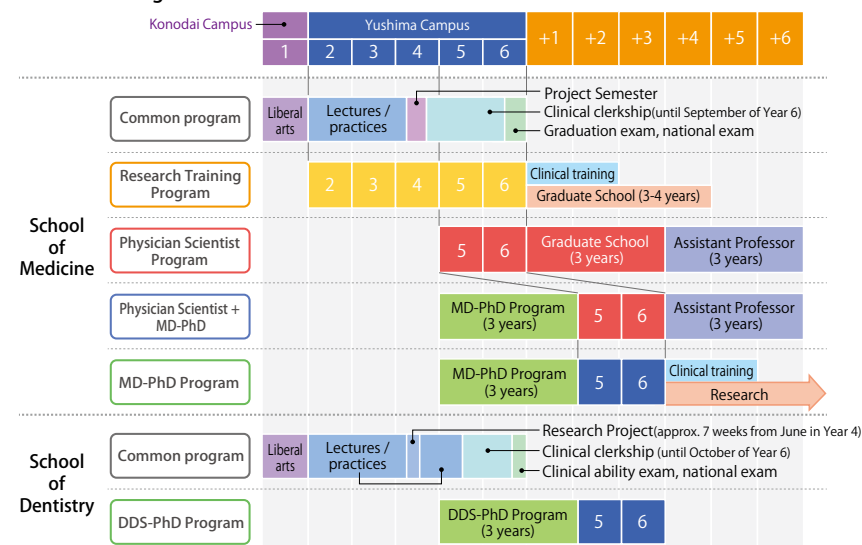
Project. Students spend April and May in Year 4 studying experimental approaches, presentation methods, statistical analysis, and other essential research-related skills. Students receiving high marks for poster presentations can be granted eligibility to present their findings in Year 5 or Year 6 at conferences or other prestigious research events.

Professor Sachiko Iseki says more dentistry students have expressed interest in pursuing a career in research since TMDU introduced the Research Project program.

Prof. Iseki: “While the 2- to 3-month program does not allow students to play a formal laboratory role, the hands-on experience is valuable for sparking interest in research. We are fortunate to have excellent students at TMDU who take the research program seriously. I think it opens them up to the novel possibility of research as a career and their potential suitability for it.”

The dentistry research program not only shows students an alternative career path, but also is useful for cultivating the skills, knowledge and research awareness needed in clinical dentistry.

### • Diverse Programs to Cultivate Tomorrow's Researchers



The School of Medicine offers the Research Training Program for M2-M6 students, a mandatory Project Semester (PS) for M4 students, and the Physician Scientist Program starting in M5. All students in the School of Dentistry undertake the Research Project for seven weeks from June in D4. After completing the fourth year, students can opt to pursue a PhD at graduate school: MD-PhD Program (School of Medicine) and DDS-PhD Program (School of Dentistry).

## Roundtable on Project Semester

# Fascinating world of research glimpsed through Project Semester in the UK

Professor Sara Rankin of Imperial College London, Professor Kazuki Takada, Director, Office for Global Education and Career Development of TMDU, and Ms. Mako Itadani, a TMDU student who spent her Project Semester (PS) in the UK, had a roundtable discussion, focusing on the benefits of PS and future prospects.



(From left) Prof. Kazuki Takada, Prof. Sarah Rankin, and Ms. Mako Itadani

**Prof. Takada:** Ms. Itadani, you spent your PS at Professor Rankin's laboratory last year. How did it go?

**Ms. Itadani:** I worked with a PhD student during my PS, and he taught me everything from techniques and experiments to how to construct and write a thesis.

**Prof. Rankin:** He is also a medical student. He took time out from his medical degree program to do his PhD. He is an excellent student.

**Prof. Takada:** Besides PS, TMDU offers several programs to nurture physician-scientists, including the Physician Scientist Program. What approaches does Imperial College take?

**Prof. Rankin:** In the UK, Imperial College is

different from many universities. It has an additional year to obtain a bachelor of science (BSc) degree in year four which is specifically dedicated to science study and research of their choice. We offer a number of different BSc programs.

**Prof. Takada:** Ms. Itadani, tell us about the physician scientists' seminars at Imperial College you attended.

**Ms. Itadani:** I attended several such meetings at which medical students and young clinicians talked about their future careers. I got to know about various courses and career paths. It was highly motivating. I met many different types of medical professionals, for example, physicians

who worked in conflict regions or space medicine scientists. I realized that physicians could display their capabilities in various fields.

**Prof. Takada:** Did your experience in the UK change your perspective concerning your future career path?

**Ms. Itadani:** After the PS I became very interested in doing research. I know it's tough and challenging but I would like to do clinical work and research at the same time in my career. I am interested in immunology and hematology because of the experience in Professor Rankin's lab.

**Prof. Rankin:** I am very much convinced that you will make a good physician-scientist.





Special Feature

## Cultivating Tomorrow's Researchers

### • Undergraduate Student Profiles

## First step on medical research path

**Fourth-year undergraduates at TMDU undertake research either via Project Semester (PS) for medical students or the intensive research program run by the School of Dentistry. A total of 40 medical students participated in the Research Training Program that is offered to students from Year 2 onward in the 2015-16 academic year. We asked some TMDU students what they had learned from their glimpse into the world of research, and what influence it might have on their future careers.**

### Keen on research before university, now even more interested in the research path

I have been interested in research since high school, and I selected TMDU because you get to do research from an early stage. The program began in Year 2, and I was able to extend the research that I did last year into my third year.

In the Asahara Lab, one research staff member provides support to a number of students. We plan each experiment and discuss the results with our advisor before repeating the cycle.

I studied basic genome editing techniques in Year 2, and in my third year I have been researching ways to stabilize RNA, which tends to disintegrate easily. It has been hard to read papers written in English with a dictionary always in one hand, but it has become more enjoyable as I have started to understand the material better.

I visit the lab once or twice a week after normal classes. The atmosphere is great, and it is easy to drop by at lunchtime or spend free time there. I was not able to visit that often in the first half of Year 2 because we were so busy attending autopsies. My lack of experience also prevented me from getting any useful data in Year 2 until

around November, but luckily I was able to get the data that I needed just in time to present my results in February.

One of my unexpected discoveries from doing research in my first two years here was the pleasure of performing simple procedures. It seems that I am good with my hands. The difficult thing about research is that you must figure everything out from square one, and you can end up with nothing if you make a mistake early on.

I plan to do a PS in Year 4 with the Asahara Lab as well, and I have already begun discussing the preparatory research with Prof. Asahara. PS requires deeper thought than the Research Training Program, and I am really looking forward to it.

#### My Research Theme

The Year 2 research project successfully applied CRISPR genome editing techniques to excise the ABCD-1 gene and replace it with foreign DNA, a procedure with possible therapeutic applications.



[Research Training Program]

**Rino Toyoshima**

(School of Medicine, Year 3)  
Field: Systemic regenerative medicine  
Asahara Research Team

## Analysis of real clinical data to develop new diagnostic method

The 6-month intensive PS program was a critical period of research for me, although I originally had no interest in research. I had found that hepatobiliary and pancreatic surgery was one of the most interesting areas in the lectures on clinical medicine, which is the reason why I chose Prof. Tanabe's lab.

My research is focused on developing new imaging methods for diagnosing neuroendocrine tumors, which are a rare disease. We needed to analyze actual patients' data, so first I had to learn how to read diagnostic scans and other clinical records. I joined fifth and sixth grade medical students in clinical clerkship for a month, and spent my spare time learning to read CT and MRI scans. I also had a chance to enroll in medical rounds with students on clinical clerkships, which was another very valuable experience.

PS was my first experience of medical

research. The learning environment was fantastic. Three doctors of surgery kindly guided me in each steps of my research. The graduate students and other staff in the lab were willing to listen to me and discuss ideas I had about the research. The research finally proposed novel non-invasive diagnostic techniques, and Dr. Kudo suggested presenting the results at a medical congress next year.

I have not yet decided if I want to go into medical research, but, whatever I do, I'm sure that the knowledge I have gained about imaging diagnostics and statistics will be helpful.

#### My Research Theme

The research focuses on the development of new imaging biomarkers for evaluating the prognosis of neuroendocrine tumors based on contrast-enhanced CT scans taken during surgery.



[Project Semester]

**Hirofumi Yamada**

(School of Medicine, Year 4)  
Field: Hepatobiliary/pancreatic surgery  
Tanabe Lab

## Valuable research experience gained in multidisciplinary UK laboratory

My studies at TMDU kindled a desire in me to do research into intractable conditions, and I could not wait to take part in the Year 4 research project. I began preparing in late August of Year 3 by learning about basics for experiments once or twice a week with the Iseki Lab.

I did my long-awaited three-month research project at Oxford University in the UK, from June to August. In our laboratory we had people from over ten different countries. My research involved using mice to evaluate treatment methods for rare conditions.

I found that I would often receive advice from lab members who were conducting research in other fields, which helped me become aware of different perspectives. Having researchers from varied fields in one place also made me appreciate the importance of language

ability and communication skills.

The research was a painstaking process involving many hours or days spent creating samples, but the experience made me keener than ever to conduct research that could benefit many people. Now I want to gain more clinical experience, figure out which field I want to specialize in, and find the right graduate school. Doing research overseas has also made me think that going to a graduate school outside Japan could be a realistic possibility.

#### My Research Theme

The research focuses on the use of chromosomal antibodies for hypoxic-ischemic encephalopathy in newborns, a condition still lacking any effective medical treatment.



[Research Project]

**Marie Kobayashi**

(School of Dentistry, Year 4)  
Field: Molecular embryology  
Iseki Lab





Special Feature

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## • Graduate Student Profiles

## Perspectives of young basic researchers

Many of the students graduating from the Faculty of Medicine and Faculty of Dentistry at TMDU advance to clinical training and will serve in the clinical field. We asked some of the graduate students delving deep into their chosen topics as basic researchers why they had chosen graduate school and what they hoped to do in the future. Some are focused purely on research, while others are conducting research alongside their clinical studies.

### Year 2 research experience leads to interest in taking 3-year PhD

I was in the process of obtaining qualifications as a medical technologist and as a cytotechnologist, and in the future I wanted to work in the field of pathology. So I enrolled in TMDU's Faculty of Medicine as a first-year student so that I could study to become a pathologist.

I studied hard with the goal of becoming a pathologist, but my experience in the human pathology lab as part of the Research Training Program in Year 2 sparked my interest in research. In Project Semester in Year 4, I took part in a joint research project with Australian National University on the functional analysis of novel proteins. I then had to choose between continuing research at graduate school or doing the Physician Scientist Program. I knew that Year 5 clinical clerkship would cut into the time I could spend on research, so I decided to enroll in the MD-PhD Program so that I could continue to pursue the research that I had started in PS more intensively.

It was hard not to be able to graduate alongside the students with whom I had spent my first four years at TMDU, but I find being able to spend ev-

ery day on research into the functional analysis of proteins very fulfilling. I feel that I have a lot of support from senior graduate students, pathology lecturers, pathology lab technicians and from my family, and that this environment will help me succeed. I am looking forward to the remaining two years of my PhD.

As a doctor, ideally I would like to make an international contribution to oncology by conducting basic research into mechanisms of carcinogenesis and discovering related therapeutic targets, while also being involved in clinical diagnosis as a pathologist. When I finish the MD-PhD Program, I still have a long way to go, including completing clinical training, passing the national medical exam, and doing initial training. I am determined to do my best.

#### My Research Theme

Focusing on the functional role of proteins in the  $\gamma$ -glutamyl cycle, the research applies approaches from molecular biology and histopathology to examine links with inflammation and carcinogenesis.



[MD-PhD Program]

**Yuriko Wada**

(1st Year PhD)

Field: Human pathology  
Eishi Lab

### Electing to do PhD after graduating to pursue goal of allergy research

I was always interested in research as an undergraduate, and I wanted to combine research with studying medicine. Switching to the Physician Scientist Program in Year 5 and having to do clinical clerkship alongside other Year 5 students was tougher than I imagined. At that stage you cannot spend all your time on research, and I felt for a time that I might be falling between two stools.

I often hear people say that it is easier to succeed in research when you are young. That was one of the reasons why I decided to do a PhD on the Physician Scientist Program rather than spending two years doing further clinical training.

I chose immunology and allergy as my field of research partly because I have suffered from atopic dermatitis myself. Ultimately I would like to have my own research laboratory, but the main goal is to discover treatments for allergy suf-

ferers. That was why the Year 5 & 6 clinical clerkship were also important to me, and why I worked hard to complete the work in parallel with my research.

The attractive features of the Physician Scientist Program include eligibility for scholarships and the early experience of presenting results at conferences. This means you can receive active support as a researcher even as an undergraduate. I am still at the basic research stage, but I hope to build on this experience to help many people as a medical researcher.

#### My Research Theme

The research analyzes a possible model for atopic dermatitis based on elucidating the polarization of Th2 cells caused by the interaction of dendritic cells with basophil leukocytes.



[Physician Scientist Program]

**Kensuke Miyake**

(2nd Year PhD)

Field: Immunology and allergy  
Karasuyama Lab

### I want to apply what I gained from research in my future career as a dentist

I wanted to be a dental surgeon when I enrolled at TMDU. I was not aware of research at that time, and had not thought about going to graduate school, but now I have returned to the Iseki Lab where I did the intensive research course. Our research is into gene expression and control in embryonic development, specifically genes responsible for formation of the choroid plexus—the parts of the cerebral ventricles that produce and secrete cerebrospinal fluid—and other parts of the brain's vascular architecture.

Research is about elucidating processes and applying trial and error repeatedly to find the answers. It involves working things out for yourself starting from scratch, a process that helps to broaden your knowledge. The

very nature of research means that my experience as a researcher will be valuable in my future work as a dentist.

I completed a master's degree in engineering at another university before coming to TMDU. So I was already familiar to some degree with experiments and research. However, I think undertaking graduate research at TMDU has helped me better understand research techniques and approaches from other fields.

I hope to remain involved with research as a dentist. I am also certain that the scientific perspective that I have acquired through my research activities will be of use as new medical treatments and technologies are developed.

[Basic Dental Research]

**Yoshinori Yokoyama**

(2nd Year PhD)

Field: Molecular embryology  
Iseki Lab

#### My Research Theme

The research uses a wild-type mouse model to study the Foxc1 gene, which affects the formation of the choroid plexus and cranial blood vessels and is thought to play a role in hydrocephalus.