TOHOKU
UNIVERSITY

The road from Interface Oral Health Science at
Tohoku University Graduate School of Dentistry to
Oral Health Scientist and Oral Health Care Professional

Tohoku University Graduate School of Dentistry 2015

Doctoral Course | Master's Course

Tohoku University Graduate School of Dentistry Leads the Next Generation of Dentistry, Dental Care and Oral Health

Director,
Tohoku University
Graduate School of Dentistry
Dean,
Tohoku University
School of Dentistry

Keiichi Sasaki

The Graduate School of Dentistry's mission is to train international leaders and highly specialized professionals of dentistry, dental care and oral health for the next generation, who have a research-oriented outlook and a scientific mind, by utilizing characteristic programs such as the Interface Oral Health Science program, the Master's course (Japan's first master's course in dentistry) and the East Asia Double Degree Program (Japan's first DD course in Dentistry). Here the education and research systems of various fields converge, utilizing the facilities of Tohoku University, one of the world's leading comprehensive universities.

The Graduate School of Dentistry, together with the School of Dentistry, the Graduate School/School of Medicine, the Institute of Development, Aging and Cancer, and Tohoku University Hospital are located in Seiryo-machi, at the foot of Kitayama Gozan, famous temples related to the powerful local lord in Oushu, Masamune Date, in the north part of an old urban area in the city of Sendai. They form one of the largest centers for medical/dental research, education and advanced medicine in Eastern Japan.

The Graduate School of Dentistry was established on the Seiryo Campus in 1972, seven years after the School of Dentistry opened. Since then, in accordance with the founding principles of Tohoku University – "to be research-oriented" "an open-door policy" and "emphasis on practical science"– the Graduate School of Dentistry has been involved in training dentists and researchers with a global perspective who will play a leading role in the broader field of dentistry, from basic research to clinical practice and oral health.

In 2000, in response to the educational policy of placing an increased emphasis on graduate schools, the Graduate School of Dentistry became an independent graduate school in Tohoku University and its new history began. As a pioneer of independent graduate-level education across the country, the Graduate School of Dentistry has been involved in a wide variety of research and educational projects to fulfil these expectations.

In 2002, we proposed a new concept to promote the reform of the existing dental research and education system, which we call "Interface Oral Health Science." At present, we are conducting a number of studies based on the "interface" concept, in a convergence of various fields. These studies are being conducted in collaboration with other departments of the university and research facilities around Japan and overseas, and we have made remarkable progress.

In 2004, to expand the range of dental medicine and oral health, as well as to "open the door" to dental research and education, we established the Graduate School of Dentistry Master's course, the only master's course in dental medicine in Japan. Currently, people who have a wide range of disciplines and a variety of careers, such as dental assistants, medical assistants, engineers, nutritionists, health and welfare administrators, and medical personnel are studying in our Master's program.

Also, significant progress has been attained in education and research with international cooperation with world-leading dental schools, including Peking University and Sichuan University Tianjin Medical University, in China and Seoul National University and the Chonnam National University in Korea. We are investigating establishing standards of dental education in East Asia, and are currently organizing a double degree program in which students can receive academic degrees from two universities.

Dental education at the Graduate School of Dentistry is supported by scientific excellence and a global perspective, which have been developed through advanced research activities in accordance with our "research-oriented" policy.

Furthermore, it has been developed into a clinical application as a "practical science." The Graduate School of Dentistry aims to train dentists and researchers with an inquiring mind and a scientific perspective who will play a central and leading role in dental research, education and practice, as well as medical administration. We are looking forward to welcoming competent, qualified and promising students to gather in Sendai, who are motivated to develop the next generation of dentistry and dental care under the rigorous school spirit of Tohoku University.

History

History of Dental Medicine and
Tohoku University Graduate School of Dentistry·School of Dentistry

Milestones in the history of modern dental medicine and Japanese dental medicine

1723	Pierre Fauchard (known the father of modern dental medicine) announces "Le Chirurgien Dentist."
1728	Fauchard makes full maxillary dentures.
1840	First modern dental medicine school in the world, Baltimore School of Dentistry, established in U.S.
1844	Tooth extraction conducted under general anesthesia using nitrous oxide.
1846	Oral surgery conducted using ether anesthesia in the U.S.
1860	American dentist William Clark Eastlake opens dental clinic in Yokohama.
	American style dental medicine becomes available in Japan.
1876	Mizuhoya imports dental equipment from U.S. to Japan.
	Production of dental equipment starts in Japan.
1878	Kisai Takayama goes to the U.S. to study dental medicine at his own expense, returns to Japan after passing exam to practice medicine as a dentist.
1881	Takayama publishes first dental technical book in Japan, "Hoshishinron."
1883	Medical practice test rules established and dental medicine becomes specialized field.
	American dentist Willoughby D. Miller announces "Miller's chemico-parasitic theory."
1888	First school of dental medicine in Japan, Tokyo College of Dental Medicine, established (closed the next year).
1890	Takayama School of Dentistry established. (In 1900, changes name to Tokyo College of Dentists; in 1946 restructured into Tokyo Dental College.)
1891	Fact that dental plaque causes tooth decay discovered in U.S.
1893	Dental Practitioners Association established (in 1926, changes name to Japan Dental Association).
1902	Japan Association for Dental Science established.
1903	School of Dentistry at School of Medicine, University of Tokyo established.
1906	Dental Practitioners Law instituted.
1911	Dental College established.
1916	Dental Practitioners Law revised to restrict doctors from practicing dentistry.
1928	Cavity Prevention Day instituted.
	Tokyo High School of Dental Medicine (currently Tokyo Medical and Dental University) established.
	Dentist training by national institutions in Japan starts.
1946	Dental Education Council begun under the General Headquarters orders.
1947	Dentist National Examination begins.
1948	Dental Education Standards Draft passed.

History of the Graduate School of Dentistry, School of Dentistry

1965	Tohoku University School of Dentistry established, advocating the philosophies of "Training dentists who can think," "One mouth is a unit," and "Holistic dentistry."
1967	Tohoku University Dental Hospital opens.
1972	Tohoku University Graduate School of Dentistry established.
1975	Dental Technicians School established.
1993	Prof. Emeritus Hajime Yamamoto awarded Japan Imperial Prize for "Research into applications related to prevention of tooth decay by laser irradiation."
2000	Tohoku University Graduate School of Dentistry, responding to the government's educational policy of emphasizing graduate schools by educating students with inquiring minds and scientific perspective who can be leaders in dental research.
2002	Interface Oral Health Science concept proposed by Tohoku University Graduate School of Dentistry.
2003	Organizational integration of Tohoku University Dental Hospital and University Hospital.
	Tohoku University Hospital opens.
2004	Graduate School of Dentistry establishes first Master's course in dentistry in Japan.
	Graduate School of Dentistry starts conducting special education in oral science for people other than those in the medical and dental field.
2005	First International Symposium on Interface Oral Health Science held.
2007	Tohoku University Dental Hospital and Medical Center renamed, beds and operating rooms moved to new location.
	"Living body biomaterial high-performance interface science project" begins, sponsored by Ministry of Education, Culture, Sports, Science and Technology.
2008	Implant outpatients accepted at Dental Medical Center of Tohoku University Hospital.
2009	Renovation of Lecture Building of Graduate School of Dentistry completed.
2010	Prof. Emeritus Shobu Hinuma awarded Order of Culture.
	Medical Dental Center outpatient clinic transferred and integrated as Dental Department of Tohoku University Hospital.
2012	Renovation of Clinical Research Building, Graduate School of Dentistry completed.
2013	Center for Environmental Dentistry established.
	Dental and Digital Forensics established.
2014	Center for Epidemiology,Biostatistics and Clinical Research established.

CONTENTS

What is Interface Oral Health Science?

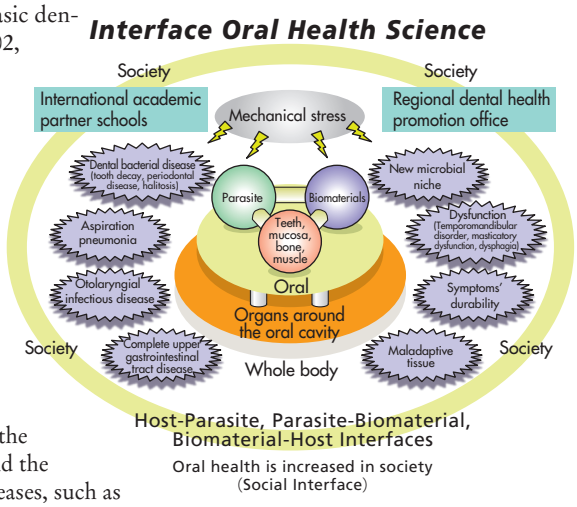
Interface Oral Health Science(IOHS), since 2002 – *Next-generation oral*

The Birth of Interface Oral Health Science

The academic field that is acknowledged as dentistry (dental medicine) nowadays was mainly treatment theory. Etiology and basic dentistry were subdivided and far from systematized. In 2002, Tohoku University Graduate School of Dentistry proposed connecting the various areas of expertise, which were at that time subdivided, and systematizing them as Interface Oral Health Science.

The oral cavity consists of 1) oral tissue (teeth, mucosa, bone, muscles, etc. – the living body); 2) parasitic microorganisms that live in the oral cavity; and 3) biomaterials, as well as mechanical stress as represented by the occlusal force. These are the characteristics of the oral cavity.

Interface oral health science concerns itself with the places where the various systems interact. In other words, healthy oral function works where the interfaces harmonize biologically and biomechanically. In addition, the oral cavity is itself an interface, between the inner body and the outside world. It is understood that oral cavity related diseases, such as aspiration pneumonia and gastrointestinal tract infections, occur due to the collapse of the interfaces between systems.



From Oral Cavity Interface to Academic Interface – and Society Interface

This concept not only covers the area of oral health science and dental science, it relates to a wide range of academic disciplines, including medicine, agriculture, materials science, pharmacology and so on. Practicing interface oral health science leads to further promotion of dental research and activation of interdisciplinary research in related areas.

In 2007, the "Highly-functional Interface Science: Innovation of Biomaterials with Highly-functional Interface to Host and Parasite" program was approved by Japan's Ministry of Education, Culture, Sports, Science and Technology, and we began collaborating with Tohoku University's Institute for Materials Research and Kyushu University's Research Institute for Applied Mechanics to conduct research and development on new biomaterials and develop clinical applications aimed at interface control. As a successor project, moreover, "Creation of a Biological and Non-Biological Intelligent Interface" was launched in 2012. These are the realization of the "Academic Interface" that aims to link existing academic fields and create a new academic discipline.

In addition, in order to achieve healthy oral function in local and international communities, it is essential to communicate with local and international communities interactively (two-way communication). In other words, it is necessary to gain an understanding of the status of the oral health of local residents, solve existing problems, and return these solutions to local communities. We also must investigate the oral health status overseas and provide what is needed, as well as cooperate with overseas research institutes and contribute to the general good by returning the outcomes of Japanese dental research to the international community. The Tohoku University Graduate School of Dentistry has set up a Regional Dental Health Promotion Office to enhance cooperation with local communities; and to strengthen cooperation with foreign research institutes, it has concluded international academic partnerships with core schools in the United States (Harvard University), Canada (the University of British Columbia), the United Kingdom (King's College London), Sweden (Umeå University), Finland (Oulu University), Asia (Peking University, Sichuan University, Tianjin Medical University, Dalian Stomatological Hospital, and Fujian Medical University in China; Seoul University and the University of Chonnam in South Korea) and Oceania (University of Sydney, Australia). They are playing an important role as "Regional and International Interfaces."

Sending out 'Interface Oral Health Science' to the World

At present, the concept of Interface Oral Health Science is widely recognized in Japan and abroad as the next generation of dentistry and oral science. In 2005, the International Symposium for Interface Oral Health Science: IS-IOHS was held in Sendai and many researchers gathered there from Japan and overseas. Its results were compiled and published as an English book and distributed around the world. Every 2 years since 2005, IS-IOHS has been held in Sendai, with publication of an English book about the new outcomes of IOHS. In addition to Sendai, the Third (2009) and Fourth (2011) Tohoku-Harvard-Forsyth Symposia (Satellite symposia) were held in Boston in collaboration with the Harvard-Forsyth Research Institute. Interface Oral Health Science is spreading more and more. Its foundation is in the characteristics of Tohoku University Graduate School of Dentistry – the uniqueness of dentistry and oral science and the desire to conduct unique research with universality to other academic disciplines; the passion of research educators and graduate students who gather at the place; and finally, the orientation toward international, interdisciplinary and fusion-oriented research.

International joint education to establish standards of dental education in East Asia

We have launched a multi-modal dentistry innovation program. This is a graduate school educational project aimed at establishing a setup for accepting overseas students, focusing on the Joint Graduate School Education system through collaboration with some of East Asia' s core universities. Another of its goals is to construct an "East Asian standard" through dentistry innovations with "global knowledge" and "integrated knowledge" as the keywords and to enhance the level of dentistry and dental treatment in Japan and East Asia.

Peking-Tohoku Dental Symposium (2013.7.26-27)

Specifically, we will step up educational and research collaborations by focusing on developing and implementing the Double-Degree Program (DD Program) with influential dentistry graduate schools in China and South Korea. Under this program, a graduate school student will be registered at two university graduate schools, receive education from the faculty of both schools, and earn academic degrees from both schools if he or she meets the requirements. By means of this setup, we aim to establish dentistry and dental treatment based on a foundation common to all of East Asia (the "East Asian standard"), and realize dental innovation.

Sydney-Tohoku Dental Symposium (2013.1.18-19)

While still enrolled in graduate school, participants in the DD Program study abroad at the partner university for a set period of time, and carry out joint research. An agreement has been made with several universities, including Peking University and Sichuan University and Tianjin Medical University in China, and Chonnam National University in South Korea. These schools have already begun accepting graduate school students from abroad.

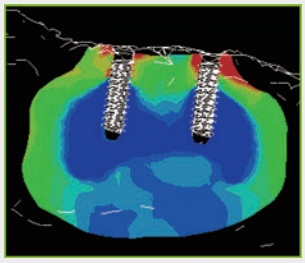
Study case of IOHS

The Living Body – Creation of Non-biological Intelligent Interfaces

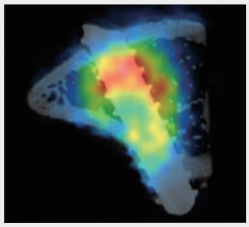
In dental treatment, biomaterials are widely used as implant materials, including titanium and calcium phosphate-based materials which are used for bone regeneration.

The Graduate School of Dentistry is committed to the development of various new biomaterials, in collaboration with, for example, the Institute for Materials Research, University of Tokyo. Furthermore, in order to increase the performance of interfaces between biomaterials and the living body, cooperative research has been conducted with Tohoku University Graduate School of Engineering and Graduate School of Biomedical Engineering.

Also, biological tissue changes according to the force applied from the outside via biomaterials, and we are pursuing the controlling of such changes by interface functions.



Stress distribution of bone around the implant in a finite element analysis model using patient data.

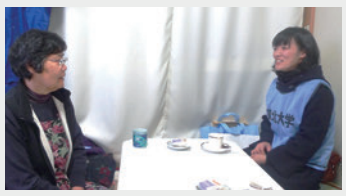


These PET images show the metabolic activity of bone around an implant when force is applied to the implant ($^{18}F^-$ isotope radioactive tracer)

Research has revealed a clear relationship between oral health and death due to pneumonia and stroke.

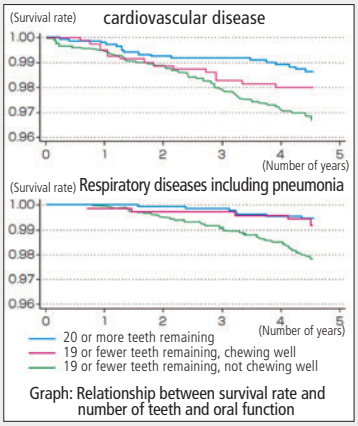
The Tohoku University Graduate School of Dentistry, in collaboration with Nihon Fukushi University and others, conducted a large-scale cohort study targeting the elderly in the city of Iwanuma, Miyagi Prefecture.

Analyzing 4,425 people followed for four years , the study showed that people with 19 or fewer teeth and who could not masticate well had a lower survival rate by major cause of death compared to people with 20 or more teeth.



A Tohoku University School of Dentistry student interviews a resident of temporary housing in the area struck by the tsunami.

The risk of death from cardiovascular disease was 83% higher, and the risk of respiratory disease mortality was 85% higher (*J Dent Res* 2011). The study suggested the risk of death from these diseases increases with the loss of teeth or not being able to masticate. It is possible to reduce the risk of death by these diseases by maintaining the health of the oral cavity. Other research we conducted showed thatwhen the oral cavity is healthy, there is less of a chance for the individual to need long-term care (*J Am Geriatr Soc* 2012).



Graph: Relationship between survival rate and number of teeth and oral function

What we study at the Graduate School of Dentistry

I The Doctoral Course

Admissions policy

The missions of Tohoku University Graduate School of Dentistry are to contribute to the progress and development of dentistry by promoting creative and innovative research, and to enhance the health and welfare of all mankind.

The goal of education and research at our graduate school is to cultivate a scientific mind that constantly questions and investigates all phenomena. To this end, we strive to produce researchers, medical professionals, educators and administrative officers equipped with high-level specialized knowledge and skills, as well as exceptional insight, who will play an active role not only in their regional community and within Japan, but also in the broader global community.

We are seeking individuals for the doctoral course who, in addition to having a strong motivation to study dentistry combined with outstanding capabilities for doing so, have a broad perspective and flexible sensibilities, and who can carry out creative, innovative, academic and groundbreaking research, following the principle of integrating basic and clinical research.

Curriculum policy

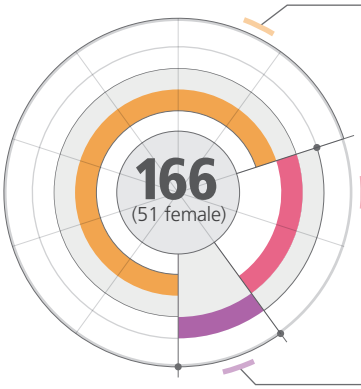
The doctoral course's dentistry curriculum, in which one student studies under the guidance of more than one instructor, encourages students to begin research at an early stage of their doctoral course, acquire expertise and specialized knowledge, and develop an interdisciplinary outlook. The Special Training for a Doctoral Thesis, provided from the first to the fourth year, helps students develop the skills necessary to write a doctoral thesis. The Basic Theory on Graduate School Research class, taken in the first year, provides students with the mass of rules that a researcher must comply with, from research ethics to various types of regulations. At the Research Theme Decision Conference, first-year students present their research proposals, and hold discussions with a variety of supervisors developing their research skills in the early stages of their doctoral education. Students are required to take the Advanced Theory of Dentistry course from the first year, in which they learn about the latest research from instructors who are experts in various fields. They acquire many different experimental techniques necessary for conducting research in the Experimental Technique Training course. In addition, Dental Seminars, in which small groups of students work with the latest research information, are designed to help develop their sense of purpose and increase their motivation to conduct research. To produce quality theses, assessments from many different viewpoints by multiple instructors are essential. To make this possible, we have been strengthening the screening setup by introducing a system of a preliminary reviewing that uses "contributing a paper to a top-rated international journal" as the chief criterion. At the same time, we provide assistance to students in giving presentations at international academic meetings, with the aim of having them cultivate a global outlook and perspective.

Diploma policy

To complete the Doctoral course, students are required to be in the program for four years or more, and earn 30 credits or more from the following subjects: nine or more credits for the Advanced Theory of Dentistry course, six or more credits for Dental Seminars, six or more credits for the Experimental Technique Training course, and nine or more credits for Special Training for Doctoral Thesis. Students must also receive the necessary research guidance and submit a Doctoral thesis, then pass the evaluation and the final examination.

Number of students in the doctoral course

(as of April 1, 2014)



70% General students

20% Adult students

Occupations of adult students

- Employed dentist, director of a dental clinic, and employee of a major chemical manufacturer

10% Foreign students

- Nationalities of foreign students include Chinese, Korean, Nicaraguan, Mexican, and Saudi Arabian

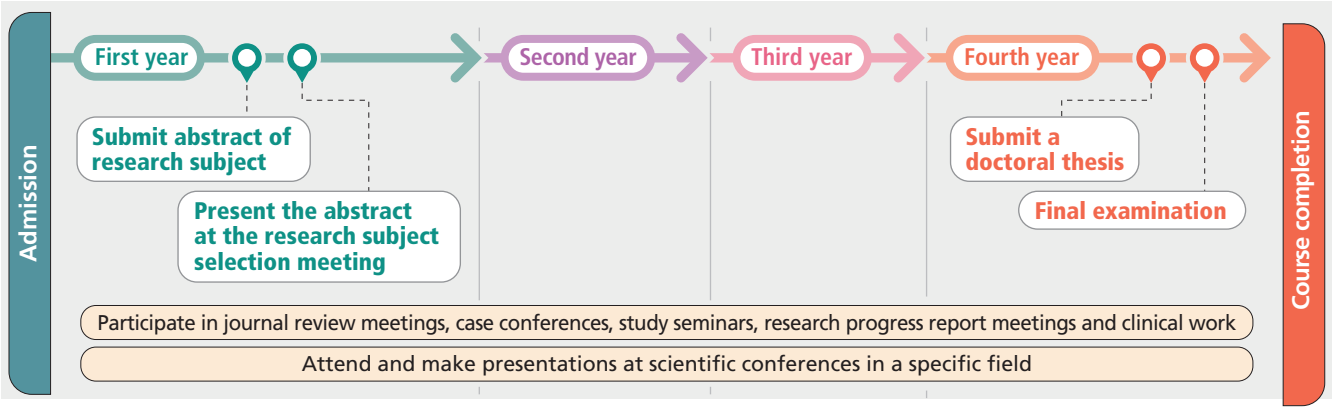
Doctoral course program

Classes (minimum credits, 30)

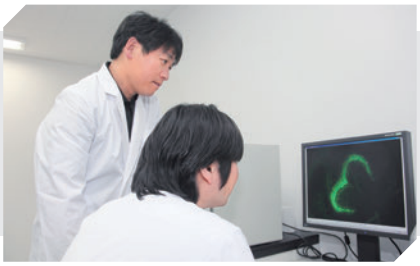
Completion of at least 3 classes each from Special Lecture on Dentistry, Dentistry Exercise, and Experiment/ Technical Training Course is required.

- **Dentistry Theory** (9 credits) — Introduction to the specific research field
- **Dentistry Exercise** (6 credits) — Exercise in the specific research field
- **Experiment Technique Training Course** (6 credits) — Technical training in experiments

Special training for doctoral thesis preparation (9 credits) — Students will earn credits by attending the class "Foundation of Graduate Research," presenting a research subject and acquiring technical knowledge



Course acceleration	Students with excellent research achievement (eg, a first-authored paper accepted by an established journal) may complete the course in 2 years.
Long-term enrollment	Working students and those with a compelling reason for long-term enrollment may stay in the course for up to 8 years with no extra cost other than the 4-year tuition.



STUDENT MESSAGE

Great research, great people, great experience.

About my life as a PhD student in Tohoku University.

Doctoral Course 1st year | Nicaragua **Vanegas Saenz Juan Ramon**

Hi!, I am a PhD student in the department of Advance Prosthetic Dentistry in Tohoku University. Since I arrived in 2013, all the people that I have met during my stay here always ask me: "Why did you choose Tohoku University?" And I always answer: "Great research, great people, great experience."

Tohoku University is at the vanguard of research. Being one of the top universities in Japan means that you have a great group of professors, graduate students and researchers working hard in the basics and clinical fields to improve our knowledge in Dentistry. Since I started my research in the area of Bone Tissue Engineering, I have learned more about the process and techniques developed for bone regeneration; and being able to discuss about this matter with my professor and advisor on how to make improvements in the field, is one of the most enrichment and gratifying experience so far.

Also, there is the opportunity to improve your clinical skills. Being able to participate in the seminars of the Tohoku University Hospital Implant Center, where Doctors from different departments, mainly from Prosthodontics and Surgery, gather together to discuss the diagnosis and treatment plan of every patient, has help me to know more about different approaches and protocols in implant treatments according to the patient's necessities.

And there is also the people, my professor, advisor and dear fellows; the culture, the food, the places and more around the Tohoku University School of Dentistry that makes it unique to do great research, to meet great people and to have a great experience.

STUDENT MESSAGE

Aim Higher, Fly Higher

Doctoral Course 2nd year | China | **Zhang Qi**

As one of my most respectful professors says, a good university can always provide you great opportunities and show you how to find your position. Before I came to Japan, I studied at West China College of Stomatology in Sichuan University, the origin of dentistry in China, as a PhD candidate. The moment I knew that there was a "Double Degree Program" of Sichuan University and Tohoku University, I set up my mind to apply for it without hesitation. It is not only because Xun Lu, the famous litterateur, once studied in Tohoku University, but also that Tohoku University has a solid research background and long historical pass and inheritance. Luckily, I became one of the first "Double-Degree Program" students of Sichuan University and Tohoku University. Now, I have been in Tohoku University Graduate School of Dentistry for half a year and everyday is rewarding

Tohoku University Graduate School of Dentistry has a very strong background of research, but what impress me most is that the atmosphere of research is very free. That is to say, if only you have interest and great idea, not limited in specific area of dentistry, the graduate school will do their best to support and help you. I am now doing research concerning signal transduction collaborated with the laboratory of Institute of Development, Aging and Cancer. It is one of the great advantages for Tohoku University that different departments have close relationship with each other and support each other. The professors here are all top experts in their fields, they acquire amazing knowledge of both clinic and research. The faculties here in Tohoku University Graduate Scholl of Dentistry are all warm-hearted and ready to help you at anytime. As for the clinic, the Clinic Tour is organized specially for foreign students. I am very excited to be able to get involved in regular clinical case discussions held for graduate students and young doctors. Also frequently held presentations given by famous professors and experts invited from other top universities benefit me a lot. No matter basic research or the clinical practice, I can always get new ideas from different kinds of such activities. Communicating with excellent experts and professors broaden my horizon and improve my way of thinking.

Tohoku University Graduate School of Dentistry innovates and offers opportunities which help me to develop a more international outlook. I always believe that only with a global perspective can I make better contribution to a broader field in the future. Here, Graduate School of Dentistry is the place helps me to spread my wings and fly up into the more expansive sky.

STUDENT MESSAGE

I am honored in being part of the Graduate School of Dentistry of Tohoku University

Doctoral Course 1st year | Mexico | **Gerardo Martinez de la Cruz**

The Graduate School of Dentistry of Tohoku University has a very active research-oriented philosophy in which you will be able to develop and acquire high scientific evidence-based medical knowledge. Students have a wide variety of fields for specializing to choose from, furthermore The Graduate School of Dentistry works very closely with other Faculties of Tohoku University such as the Materials Science, Biomedical Engineering, Fluids Science, etc. So the possible topics for studying and researching are really endless.

Each department has weekly journal club and seminar sessions in which students are kept up to date with the latest trends published in international articles, we also have regularly "research conferences" in which classmates expose their research advances.

The student support is top notch in every way possible, one good example would be the encouragement and support we receive to expose our research advances in national and international conferences and congresses. Overall, the Graduate School of Dentistry has a very open and friendly environment in which you can feel comfortable.

Studying in this world renowned University is a unique and great experience, I have no doubt it will help me reach my personal and professional goals.

The facilities, opportunities, resources and expert guidance in every field of dentistry -clinical or basic- are here, it depends entirely on how much YOU take advantage of all of this. "Be an Oral Scientist".

II The Master's Course

Chronology of events that led to the establishment of the Master's course

Dental medicine has been progressing rapidly in recent years, and dental treatment support staff, such as dental hygienists, technicians and other professionals, is now being expected to acquire an even wider range of advanced knowledge and to possess specialized skills based on such knowledge. To promote the research and development of dental equipment and materials that support advanced dental medicine, moreover, it is becoming an urgent task to train researchers and developers who are familiar with the latest advances in dentistry and oral science.

On the other hand, the importance of oral functions such as eating and speaking is becoming more broadly recognized. People in occupations who have no opportunities to receive specialized dentistry education, such as nurses, speech therapists, nursing teachers, and health administration officials are increasingly being called on to demonstrate knowledge and skills relating to dental and oral care in executing their nursing, long-term care, health guidance, public relations, and other awareness-raising activities. Examples include the provision of oral health guidance and management, and education on maintenance of the oral cavity.

In April 2004, the Tohoku University Graduate School of Dentistry established a new Master's program especially for these types of individuals, and opened the door for specialized education and research in dentistry and oral science with the aim of cultivating the abilities needed for such advanced specialist professions, or the ability to conduct research on dentistry and oral science.

Admissions policy

The missions of Tohoku University Graduate School of Dentistry are to contribute to the progress and development of dentistry by promoting creative and innovative research, and to enhance the health and welfare of all mankind.

The goal of education and research at our graduate school is to cultivate a scientific mind that constantly questions and investigates all phenomena. To this end, we strive to produce researchers, medical professionals, educators and administrative officers equipped with high-level specialized knowledge and skills, as well as exceptional insights, who will play an active role not only in the regional community and within Japan, but also in the broader global community.

The Master's course seeks individuals who have diverse and specialized academic knowledge and skills related to oral health, hygiene and public health, health science, speech and language therapy, medical sociology, agriculture, engineering, and science, and who are willing to carry out active research into dentistry and oral science.

Curriculum policy

The Master's course curriculum, which is designed to provide flexible programs that meet students' interests, consists of a wide range of basic and specialized subjects, beginning with Introduction to Dentistry, and covering subjects needed for future dentistry and oral science such as Medical and Dental Biomaterials, Theory of Medical/Dental Equipment, Food Science, International Dental Health, and Social Dentistry. Each student studies under the guidance of more than one instructor. During the first year, students take Introduction to Dentistry as well as Introduction to Clinical Dentistry and Practical Training at Hospitals to acquaint themselves with dentistry and dental medicine. In the Special Training for the Master's Thesis, which covers the period from the first to second years to the completion of a Master's thesis, students study the Basic Theory of Graduate School Research to familiarize themselves with matters that govern all research, from ethics to technical regulations. They then summarize their research themes and plans as a Summary of Theme Selection, allowing them to begin research at an early stage of the Master's course. These courses allow dental hygienists and technicians, nurses and other healthcare professionals, as well as graduates in science and engineering, and nutrition and health, to acquire extensive knowledge and advanced research skills in dentistry and oral science that will enable them to contribute to maintaining and promoting these areas in public health.

Diploma policy

To complete the Master's course in dentistry, students must be enrolled for two years or more, and earn 30 credits or more (18 credits or more from compulsory subjects and 12 credits or more from elective subjects). They must also undergo the necessary research guidance and submit a Master's thesis, then pass the evaluation and final examinations to be certified as having completed the course.

If a student is recognized to have made outstanding research achievements, only one year of study is required.

Students who are currently employed or subject to other special circumstances are permitted to study for more than two years under the planned schedule, during a period to be determined by the School.

Master's course program

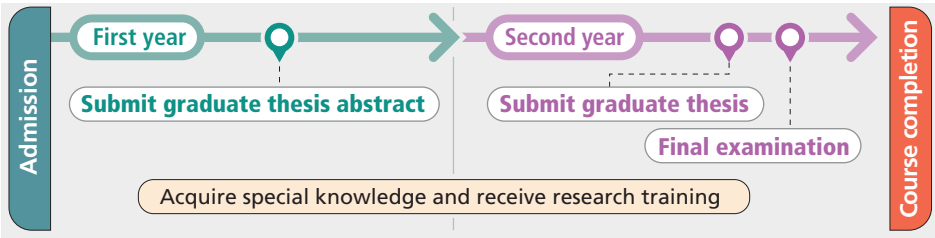
Classes (minimum credits, 30)

Required (18 credits) Minimum of 3 classes in each of the following courses to be completed:

Introduction to Dentistry, Introduction to Clinical Dentistry and Hospital Tour/Practicum, Special Training for Master's Thesis Preparation, Research and Technological Training

Electives (12 credits) Minimum of 6 of the following courses to be completed:

Dental Biology, Dental Pathology, Biomedical Material Study, Introduction to Medical Devices, Food Science, International Dental Health, Social Dentistry, General Dentistry, Oral Growth and Development, Oral Repair/Restoration, Stomatognathic Function, Dental Treatment for Disabled People, Geriatric Dentistry, Dental Infection Control, Stomatognathic Reconstruction, Oral Immunological Disease Control, Longevity Oral Science, Oral Health Science Theory, Special Training for Oral Care in Cancer Therapy

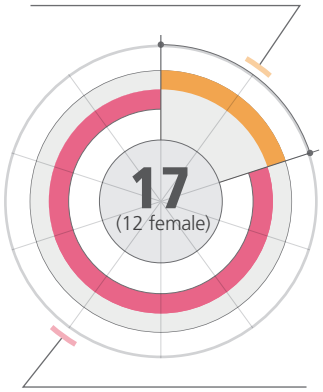


Course acceleration Students with excellent research achievements (eg, a first-authored paper accepted by an established journal) may complete the course in one year.

Long-term enrollment Working students and those with a compelling reason for long-term enrollment may stay in the course for up to 4 years with no extra cost other than the 2-year tuition.

Number of students in the master's degree course

(as of April 1, 2014)



Occupation of adult students

School nurse, dental hygienist, employee at a major pharmaceutical company, teacher at a dental technician school, etc.

Admission fee and tuition

Admission fee 282,000yen **Tuition** (year) 535,800yen

*The amount of the admission fee and tuition is subject to change. The newly established amount will be applicable at the time of admission or while the student is enrolled.

Financial support system

Admission fee/tuition waiver

The entire admission fee/tuition or one-half or one-third of tuition may be waived upon a request for students with excellent academic performance having difficulty paying the admission fee and/or tuition due to financial reasons. The information on the waiver program will be included in the admission documents.

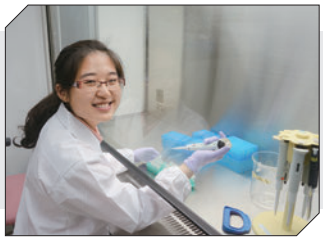
President Fellowship / President Fellowship for Undergraduates

This scholarship system is unique to Tohoku University. It provides an amount covering tuition fees for international students of excellent character and academic standing.

Japan Society for the Promotion of Science Fellowship Program

The program provides fellowship support to researchers with excellent research ability, who are taking or have completed the doctoral course and wish to join research institutes such as universities in the future.

A monthly amount of 200,000 yen (estimated in 2014) will be provided to fellows in the doctoral course.



Japanese Government (MEXT) Scholarship applying from within Japan

Students can apply as self-financed foreign students through recommendation of Tohoku University.

Other Scholarship

Self-financed foreign students may be eligible for scholarships under the JASSO Honors Scholarship for Privately Financed International Students, or for scholarships offered by private foundations. These scholarships vary with regards to recruitment procedures, eligible fields of study, and amount, but in general students apply for them through Tohoku University.

Teaching Assistant (TA) and Research Assistant (RA)

Students who assist in classes or research activities will be paid an allowance (hourly rate).

The program provides students with financial support as well as opportunities to teach and instruct other students or learn how to proceed with research activities and construct theories.

School of Dentistry Researcher Development Program

The School of Dentistry has a researcher development program to help doctoral students become international researchers and enhance their research activities. Up to 300,000 yen will be paid per student as travel expenses and conference participation fees.

STUDENT MESSAGE

Message from Foreign Student

Doctoral Course 4th year | Saudi Arabia **Nezar Mohammed A. Boreak**

I am Nezar Mohammed Boreak, from Division of Periodontology and Endodontology in graduate School of Dentistry.

When I got chance of my scholarship from my country, I confirmed that my dream would be happen to go to Tohoku University. Tohoku University has strong educational curriculum with strategy for personal education and also introduced numerous scientific researches to the field of Dentistry, especially in my field of Endodontic. I thought I would be coming to a world-class lab. I am not disappointed. I got help and advice on my research from my professor SHIMAUCHI. I going to graduate but really when I came from my country to Japan I didn' t have any idea about the research. However, now I will return to my country with extensive knowledge in the field of research.

Finally, Training in the Tohoku University Hospital Dental Clinic is highly advanced: the clinic has supplied with high quality machines and instruments and are supervised staff members. I recommend all of you for studying at Tohoku University. I am happy to study in Endo- Perio department.

Variety of educational programs

Double degree program

The double degree (DD) program of Tohoku University Graduate School of Dentistry is a graduate school educational project involving the major graduate schools of dentistry in China and South Korea to improve dentistry and dental care in East Asia by developing East Asian standards through innovative dentistry based on global and integrated knowledge.

In the DD program each graduate student enrolls at two universities and studies at the sister school for a specific period of time. The DD program offers an opportunity to study under the faculties of two universities at the same time. Students will be able to earn degrees from both universities if the requirements are met.

Coordination with other research departments and institutions

A cross-department, integrated educational program involving the Schools of Medicine, Pharmacy and Engineering is available for the students at Tohoku University School of Dentistry. Students will be able to receive guidance from members of non-dentistry faculties.

Future Global Leadership Program

Tohoku University Graduate School of Dentistry launched the new course "Interface Oral Health Science Course" taught entirely in English from 2011.

The conceptual objective of the "Interface Oral Health Science Course" is to integrate the diverse research achievements of the Graduate School of Dentistry in order to advance the understanding of issues concerning oral health. We offer an English education program covering wide range of Oral Health Science.

Dental oncologist training course

This course provides training for dentists to become dental oral surgeons specializing in oral cancer treatment.

Students will take the systematic lecture course to obtain general and particular knowledge about clinical oncology required for cancer treatment, participate in clinical work at affiliated institutions and related departments at the School of Medicine and prepare a thesis related to oral oncology in the doctoral dissertation program.

STUDENT MESSAGE

The foreign exchange program was just what I expected

Doctoral Course 2st year | China **LONG JIANLAN**

After graduating from Sichuan University, I came to Tohoku University School of Dentistry in the academic exchange program as recommended by my academic supervisor. My time at Tohoku University has been so fulfilling because I can increase my capacity as a researcher by learning advanced Japanese technologies, how to conduct research and write a dissertation.

I have no financial worries because my daily expenses are fully covered by the government scholarship. Sendai combines a green environment and urban sophistication. It is a very pleasant place to live.

The faculty members and fellow students are so kind to me. They help me with my studies and with learning Japanese. Tohoku University is promoting international exchange in research areas. My research on sleep apnea has been progressing in cooperation with the University of Sydney. Through studying with exchange students from Ukraine, Saudi Arabia and Mexico, I am learning about different cultures, values and ideas.

I am going to continue my research at a Chinese university and contribute to the improvement of research standards in China and the education of the next generation by using the knowledge and skills gained while I am in Japan.

What can you do at Tohoku University?

Academic	◦ Joint research with overseas universities ◦ Clinical skills program ◦ Clinical tour/simulation training
Culture	◦ Special Japanese classes ◦ Cultural exchange with local Japanese society ◦ Experiencing Japanese traditional culture such as tea ceremonies and kabuki

Entrance examination information

Selection procedures

	Doctoral course	Master's course
Special screening for foreign exchange students	Written examination (specialized subject) Interview Application screening	Written examination (Short essay writing) Interview Application screening
Special screening for working students	Interview Application screening	Written examination (Short essay writing) Interview Application screening

Qualification Screening

Applicants who graduated from foreign universities have to undergo the qualification screening for application in advance. Please contact us by e-mail before the beginning of qualification screening, if applicants want to obtain more detail information.

e-mail: international@dent.tohoku.ac.jp

Examination schedule *No student recruitment for master's degree course in October 2014

	Admission in October 2014 (doctoral course only)	Admission in April 2015	
		First Recruitment	Second recruitment
Accepting applications for Qualification Screening	May 26 to May 30, 2014	May 26 to May 30, 2014	October 27 to October 31
Accepting application	June 16 to June 20	June 16 to June 20	November 17 to November 21
Examination date	July 23	July 23	December 15
Announcement date of examination results	August 5	August 5	January 22, 2015

Oral Biology

Oral Ecology and Biochemistry

Professor Nobuhiro Takahashi

The oral cavity forms an ecosystem where the host (humans) and parasites (a tremendous number of microorganisms) cohabit. Using leading-edge techniques, we conduct research on the role of oral biofilm in oral health and disease from an oral ecosystem viewpoint. In addition, we propel clinical research on caries-preventive effects of xylitol, fluoride etc, and on parasite-induced deterioration of biomaterials. Recently, we have also started metabolomics research on oral cancer.

Anaerobic chamber, simulating anaerobic conditions in oral biofilm.

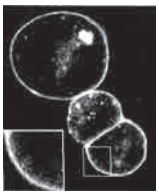
◆ Main research themes

- Genomics, proteomics, and metabolomics of oral biofilm
- Metabolism and pathogenicity of microorganisms associated with dental caries, periodontal disease and oral malodor, using an anaerobic experimental system
- Caries-preventive properties of sugar alcohols/fluoride and cariogenic evaluation of food products using pH-telemetry
- Oral biofilm-induced deterioration of dental biomaterials
- Metabolomics of oral cancer

Dental Pharmacology

Professor Minoru Wakamori

The major goal of our research programs is to elucidate the operating principles of the body to keep homeostasis on the molecular level by utilizing electrophysiological and molecular biology techniques. Specifically, we are interested in mechanisms to regulate intracellular Ca^{2+} concentration, and transduction mechanisms of oral sensations.



Cellular localization of TRPC5-eGFP fusion protein expressed in a single HEK293 cell.

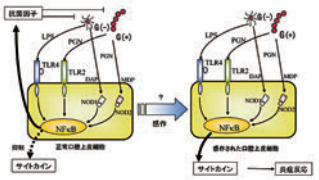
◆ Main research themes

- Functional Analysis of Ca^{2+}-permeable Cation Channels
- Molecular and Neurobiological Studies of Taste, Pain and Touch Sensations

Oral Microbiology

Professor Haruhiko Takada

In the past two decades, immunologists have been excited about the innate immune system, which paternally recognizes various common microbial structures. Cell-surface Toll-like receptors (TLRs) recognize bacterial cell-surface components, while intracellular NOD1/2 recognize bacterial cell-wall peptidoglycan: NOD1 and NOD2 recognize desmuramylpeptide and muramyldipeptide (MDP), respectively. With the aim of elucidating the pathogenesis of infectious diseases in oral mucosa, represented by periodontal diseases, we have investigated innate immune responses via TLRs and NOD1/2 in various cell cultures prepared from human periodontal tissues.



Normal oral epithelial cells express various TLRs and NOD1/2, and produce anti-microbial peptides not accompanied by the production of inflammatory cytokines in response to comparable ligands. On the other hand, primed cells produced inflammatory cytokines.

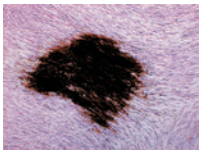
◆ Main research themes

- Innate immunity in periodontal tissues and periodontal diseases
- Bacterial cell-wall peptidoglycans in relation to innate immunity
- Immunobiological activities of bacterial cellular components, especially those from oral bacteria
- Mechanisms of apoptosis induced by anti-tumor drugs in cancer cells

Periodontology and Endodontology

Professor Hidetoshi Shimauchi

One of our projects is studying on the onset mechanism of periodontal disease (marginal and apical periodontitis), representative chronic inflammation in the oral cavity, in terms of the interaction between host cells and bacteria, and also we study on the regenerative mechanism of periodontal tissue. In addition, I perform the study for apply ME such as lasers for periodontics and endodontics.



The calcified nodule formed of Periodontal Ligament Cells.

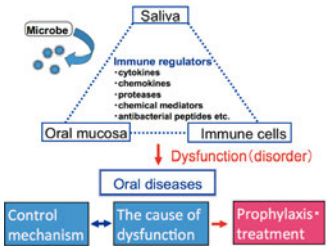
◆ Main research themes

- Analysis of the onset mechanism of marginal and apical periodontitis
- Analysis of the interaction between cells in the periodontium
- Analysis of the periodontal regenerative mechanism and application to the treatment
- Development of method for periodontal diagnosis using ME
- Development of periodontal regenerative therapy using new biomaterials

Oral Molecular Bioregulation

Professor Shunji Sugawara

Interaction among oral mucosal cells, saliva and immune cells through immune regulatory factors and cell-to-cell contact is critical for mucosal defense, and dysfunction (disorder) of the interaction leads to onset of oral mucosal and salivary gland diseases. We investigate the underlying molecular mechanism to overcome these diseases.



Oral mucosal defense and research aim

◆ Main research themes

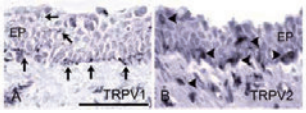
- Host Defense and Diseases in the Oral Mucosa
- Inflammatory Mediators and Cytokines in Pathological Conditions
- Immune Regulation of Saliva and Diseases in the Salivary Glands
- Mechanism of Metal Allergy Development
- Regulation of Inflammation by Biotin

Oral Function and Morphology

Oral and Craniofacial Anatomy

Professor Hiroyuki Ichikawa

Our division has research themes about the human anatomy, particularly focused on oral structures. The morphology of human and other mammalians is also compared. In addition, we are interested in motor, sensory and autonomic systems of oro-facial regions. For this purpose, the distribution and function of neurotransmitters, neuromodulators and others substances is investigated in the central and peripheral nervous systems. Morphometric methods are used for these anatomical and microscopic studies.



Arrows (A) and arrowheads (B) indicate TRPV1-positive nerves and TRPV2-positive cells in the rat pharyngeal mucosa, respectively.

◆ Main research themes

- Distribution and function of various sensors in the orofacial and cervical regions of human and other mammalians
- Change and mechanism of the pain threshold in animal chronic pain models
- Mechanism of motor and sensory dysfunction in muscular atrophy diseases

Dental and Digital Forensics

Professor Keiichi Sasaki (collateral office)

Forensic dentistry is the science concerning the application of dental evidence to the resolution of legal problems. We aim to integrate the advanced knowledge and skills of information science into conventional research methods in forensic dentistry. Our division is the first and only one laboratory in the northern Japan, engaged in research and education of forensic dentistry. The education goal of the division is that the students gain knowledge and understanding of the process of forensic dentistry in Japan and of personal identification using dental records or skeletal remains.

◆ Main research themes

- Morphological studies on the human skeletal remains
- Morphological studies on the teeth of Japanese
- Application of dental Information in identification
- Comparative odontology on the mammals
- Mass fatality incident management and assistance

Oral Physiology

Professor Minoru Wakamori (collateral office)

Oral physiology mainly concentrates on the research on biological processes in the oral and maxillofacial regions. We are in the field of fundamental studies that establishes basic theories from our understanding of physiological functions, such as mastication, oral sensation including gustatory sensation, function of saliva and vocalization. Presently, many still unanswered questions exist in regards to the oral and maxillofacial region's connection to overall bodily functions, including higher brain functions. In the department of oral physiology we focus on individual organism and cell level research that investigate these questions by using electrophysiological and molecular biological techniques.


A spinal dorsal horn neuron and serotoninergic axon terminals.


Distribution of synapses between a spinal dorsal horn neuron and serotoninergic axon terminals.

◆ Main research themes

- Neurophysiological analysis of information-processing mechanisms in cortical somatosensory system
- Analysis of receptor mechanisms through mechanical stress in the periodontal tissues and its control by gene transfer
- Analysis of differentiation and regeneration inducing signal reception and its transmission mechanism in neurons and osteoblasts

Advanced Prosthetic Dentistry

Professor Keiichi Sasaki

Focus of research and education of our division is on reconstruction of morphology and function of the patients with partial edentulism or maxillofacial defects. In addition to developing the conventional prosthodontic modalities such as removable and fixed dentures, we aim to create novel prosthodontics utilizing the dental implant, tooth transplantation, and tissue regeneration, and to clarify the biomechanical and mechanobiological interaction at the interface between prostheses consisting with biomaterials and living tissues, which is essential for the success of prosthodontics.

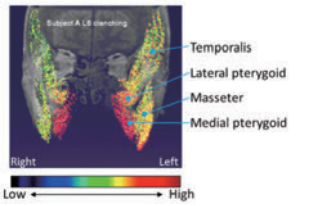
◆ Main research themes

- Biomechanics based upon in vivo measurements of mechanical features relating to removable partial denture prosthetics and implant prosthodontics
- Molecular imaging study with nuclear medicine on bone remodeling related to removable partial denture prosthodontics and implant prosthodontics
- Study on transplantation and regeneration for edentulous prosthodontics and maxillofacial prosthetics
- Development and translational researches of novel biomaterials and functional interface between biomaterials and living tissues
- Study on Long-term clinical results of removable partial dentures and implant prosthodontics

Aging and Geriatric Dentistry

Professor Yoshinori Hattori

Through gaining a broad range of experience on dental practice, which includes collaboration with various different professions, in outpatient and domiciliary care, we examine how best to ensure geriatric oral health care in the future. We also spend enormous effort investigating the interrelation between oral and systemic health/QoL thorough longitudinal cohort study, and also developing evaluation and rehabilitation methodologies of various oral functions.



Mapping of masticatory muscle activities registered by using mfMRI (left unilateral molar clench)

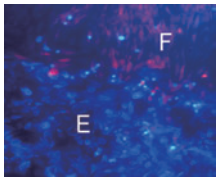
◆ Main research themes

- Analysis of causal relationship of oral and systemic health/QoL through large-scale cohort study.
- Development of evaluation methods of oral functions by applying and combining diverse modalities.
- Research on the aging of oral functions
- Study on the delivering system of multidisciplinary dental care for the elderly

Comprehensive Dentistry

Professor Masahiko Kikuchi

The department of comprehensive dentistry aims to develop superior primary care in general dentistry and also practices the management of clinical training program for post graduate residents. Furthermore, following basic and clinical research projects are conducted with the graduate students of this department.



The role of epithelial rests of Malassez to promote periodontal regeneration.

◆ Main research themes

- Periodontal regeneration using periodontal ligament cells
- Relationship between dental diseases and systemic illness
- Circadian rhythm of dental pain
- Oral hygiene and oral microorganisms in the elderly
- Development of effective treatment methods in primary care

Restorative Dentistry

Dental Biomaterials

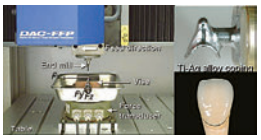
Professor Osamu Suzuki (collateral office)

Dental and medical restorative materials are studied under developments of dental alloys, magnetic materials and devices, new implant materials, and machining and forming methods. Furthermore, degradation and safety of the dental restoration materials are inquired.

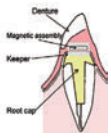
◆ Main research themes

- Development of new dental titanium alloys and their clinical application
- Research on mild antimicrobial or bacteriostatic dental alloys
- Research on functional devices and dental applications using magnets
- Research on new cutting- free dental materials suited to the CAD/CAM system
- Research on deterioration and safety of dental materials in an oral cavity

Osseous tissue formed on a titanium surface


Measurement of cutting force

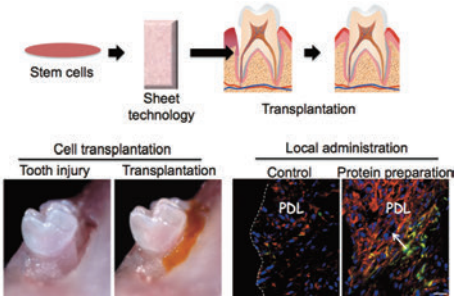
Machining by a CAD/CAM system


Dental magnetic attachments

Operative Dentistry

Professor Masahiro Saito

We work mainly on research of the following topics from a clinical perspective: physical properties of composite resins used in restoration for diseases of the hard tissues such as the dental carries; measurement of adhesive strength onto enamel and dentin; observation of adhesion/joining conditions by electron microscope; long-term clinical performance of oral restorative materials using the replica method; conformity precision with respect to castability of titanium restorative materials and dentin; and strengthening of the physical properties of porcelain inlays. We also work on clinical studies that are re-restoration treatment with materials not containing allergic materials, and application of novel disinfecting technique using functional water. In addition to these studies, we develop regenerative therapy which expected to create innovative dental therapeutic systems in the 21st century. A feasibility study of the realization of tooth regeneration therapy is performed in research projects that are stem cell transplantation and local administration of bioactive molecules.



Development of tooth regeneration therapy
A model for tooth regeneration therapy (Upper panel)
Cell transplantation by using sheet technology (Lower left panel)
Local administration of bioactive molecules (Lower right panel).
Arrow indicated regeneration of fibers in tooth.

◆ Main research themes

- Development of Tooth Regeneration Therapy
- Investigation of Molecular Mechanisms that regulate Periodontal ligament formation
- Research Related to Physical Properties and Adhesion/Joining Conditions onto Dentin of Composite Resin
- Research Related to Dental Precision Casting and Level of Conformity of Pure Titanium and Titanium Alloys
- Research Related to the Strengthening of Physical Properties and Clinical Application of Ceramic Inlays
- Research Related to Dental Metal Allergies

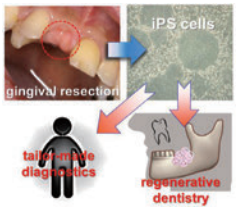
Molecular and Regenerative Prosthodontics

Professor Hiroshi Egusa

Our major research focus is the development of next-generation biotechnology to 1) regenerate missing alveolar bone and teeth for functional and esthetic rehabilitation using cells and biomimetic materials and 2) introduce tailor-made diagnostics for prosthetic and implant treatments to prevent further tooth loss.

◆ Main research themes

- iPS cell-based oral tissue engineering
- Development of gingiva-derived iPS cells for safe therapeutic application
- Biomimetic materials for bone tissue engineering
- Chemical biology for bone regenerative medicine
- Osteo-immunology in alveolar bone resorption
- Development of genome-based diagnostics for prosthetic/implant treatments
- Basic and clinical research on all-ceramic restorations



The patient's gingiva resected during dental treatment is a promising iPS cell source for oral tissue engineering applications, as well as for in vitro applications for tailor-made diagnostics.

Oral Health and Development Science

Preventive Dentistry

Professor Takeyoshi Koseki

The Division of Preventive Dentistry aims to prevent all oral disorders and to promote and maintain oral health and its full function. In the trend of rediscovering the importance of preventive dentistry, our researches focus on the effective measures of preventing oral diseases and the strategies of health promotion involving the individual QOL throughout their entire lifetime.

◆ Main research themes

- Estimation of progression and future risk of dental caries
  1) Accurate evaluation of early lesion of dental caries by using ultrasonic devices
  2) Risk assessment of enamel surfaces by using laser technology
- Risk assessment of periodontal diseases
  1) Analysis of microbiological risk factors of dental plaque
  2) Development of effective protocol of periodontal supportive therapy
- Oral malodor research
  1) Microbiological study of source of malodor
  2) Development of portable measuring system of oral malodor
  3) Psychological approach of treatment of oral malodor
- Application of fluoride for caries prevention
  1) Promotion of fluoride application in public measure of caries prevention
- Field research of community oral health
  1) Development of educational dental health checkup with health promotion
  2) Monitoring the prevalence and incidence rate of oral diseases


Portable measuring system of oral malodor

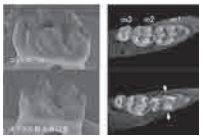
Pediatric Dentistry

Professor Satoshi Fukumoto

Our division promotes clinical, basic and epidemiological research for tooth development, tooth trauma, mucosal disease to create healthy oral environment in children.

◆ Main research themes

- Identification of novel gene involved in tooth development
- Analysis of gene associated with oral disease
- Development of stem cell research associated with syndromes
- Study of enamel formation
- Regeneration of tooth and salivary gland using tissue engineering
- Evaluation of new materials for prevention of dental caries


Enamel dysplasia using gene targeting (left). Control of tooth width using gene manipulation.

Orthodontics and Dentofacial Orthopedics

Professor Teruko Yamamoto

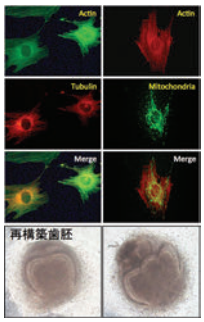
One of the clinical dental department that focus on a research related to the diagnosis and treatment of abnormal morphological and functional occlusion. Our aim is to develop a new diagnosis and treatment methods and to elucidate craniofacial growth mechanics, by various clinical and basic scientific research.

We also offer a 3-year postgraduate orthodontic clinical training program with addition to the PhD course. Our department is accredited by the Japanese Orthodontic Society as a training institute for orthodontic specialists.

◆ Main research themes

1. Clinical research
- The use of miniscrew as an orthodontic anchorage
- The use of functional evaluation (gnathohexagraph) in orthodontic treatment
- Relationship between Sleep Apnea Syndrome and orthodontics
- The use of various occlusal indices in quantitatively evaluating the quality and severity of the pre- and post malocclusion in orthodontic treatment

2. Basic research
- Experimental tooth movement and bone remodeling
- Molecular mechanism of tooth movement
- Biological mechanism of mechanical response in osteocytes
- Biological mechanism of craniofacial development
- Biohistological study of development, growth and aging of TMJ
- Histomorphometric study of bone-implant interface
- The control of pain during othodontic tooth movement



fluorescent images of subcellular organelle

Oral Dysfunction Science

Professor Kaoru Igarashi

Oral Dysfunction Science is a clinical dentistry field specializing in research on the normal morphology, function, and development of the stomatognathic system, problems caused by abnormalities, and their treatment.

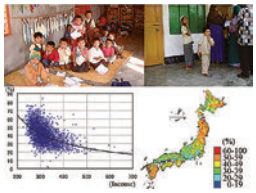
◆ Main research themes

- Research on efficient tooth movement
- Research on the diagnosis and treatment of maxillofacial congenital anomalies, such as cleft lip and palate (CLP)
- Development of new anti-inflammatory bisphosphonate drugs that also promote bone formation
- Research on the role of immune cells in osteoclastogenesis

International Oral Health

Professor Ken Osaka

We have carried out research on the influence that the social capital, or bonds to humans and society have on dental health. We have shown socioeconomic status has an impact on the number of remaining teeth in a cohort study. We have also established the number of remaining teeth has associated with the tendency of becoming nursing care-dependent and pneumonia deaths. We are working on education of young students in international support for developing countries, as well as analyzing the oral health condition and health inequalities in Japan and deepening our understanding of the dental care system, long term care insurance system for the elderly and dental public health.



◆ Main research themes

- Association of dental status and society
- Construction of a Project for Effective Prevention of the Need for Nursing Care
- The Dental Care System and Health Gap
- Infectious Disease Countermeasures and Risk Management for Nursing Care Facilities

Oral Medicine and Surgery

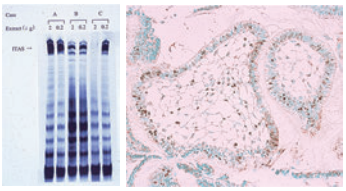
Oral Pathology

Professor Hiroyuki Kumamoto

To clarify the etiology, pathogenesis, pathophysiology, and outcome of various lesions occurring in the oral and maxillofacial region, basic macroscopic and microscopic observations as well as further analyses are performed. Our division research fields are as follows.

◆ Main research themes

- Molecular pathology of lesions of the jaws
- Clinicopathological and genetic studies of developmental abnormalities of the teeth
- Clinicopathological and immunohistochemical studies of the oral immune diseases and cancer
- Investigation on regeneration of the oral and maxillofacial tissues and application of biomaterials


Expression of telomerase in ameloblastoma (a: TRAP assay, b: immunohistochemistry)

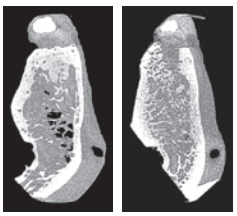
Oral Diagnosis

Professor Takashi Sasano

Oral diagnosis should be defined as a systematic process of identifying oral diseases. To obtain an accurate diagnosis that decides proper and rationale treatment planning, our research is focusing on the relation between oral and systemic diseases, and diagnostic imaging of maxillofacial lesions. We are also interested in clinical research of taste disorder, dry mouth and pain based on physiological evidence, and we treat these diseases.

◆ Main research themes

(1) Clinical study on the relation between oral symptoms and systemic diseases
(2) Diagnostic imaging of maxillofacial lesions
(3) Clinical research of taste disorder, dry mouth and pain based on physiological evidence
(4) Interactions between pain and blood flow


The micro CT 3D images of the crab-eating monkey jaws. Left: The osteopolosis monkey model. Right: Control.

Oral and Maxillofacial Surgery

Professor Tetsu Takahashi

In our division, we cover the diseases of congenital deformities, jaw deformities, benign and malignant tumors, and trauma in oral and maxillofacial area. Our research topics focus on the control and reconstruction of those diseases.

◆ Main research themes

- Research on morphological and functional reconstruction in the oral and maxillofacial area.
- Research on bone augmentation using distraction osteogenesis and periosteal expansion
- Research on various augmentation method for implant placement
- Research on dento-alveolar reconstruction in patients with cleft lip and/or palate
- Research on pathophysiology of temporomandibular joint disorders
- Research on treatment modalities for facial trauma
- Basic and Clinical research on bone substitute
- Research on control of growth and invasion, and surgical reconstruction of oral tumors.
- Development of bone substitute with bone forming property
- Development of dental implants with bone forming property
- Diagnosis and Surgical simulation in patients with jaw deformities using 3D CT/photo
- Dento-alveolar reconstruction using Tissue Engineering


Before bone graft

A case of dental reconstruction after bone grafting to the alveolar cleft in a patient with cleft lip and palate.


After bone graft


After dental reconstruction

Dento-oral Anesthesiology

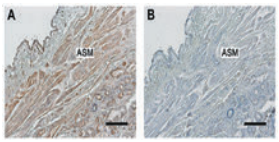
Professor Eiji Masaki

The purpose of research activity in our division is focused on removal of any hardship in patients undergoing surgery and dental procedure. Control of pain, avoidance of medical complications, and offering comfortable environment for treatment are included in this purpose. The results of our study could reduce cost of medical treatment as well as improve quality of life of patients.

◆ Main research themes

- Clarification of pain regulatory systems in the spinal cord
- Development of new therapeutic modalities for intractable pain including postoperative pain
- Development of new therapeutic approaches for bronchial-spasm and asthma
- Investigation into lung epitheliums with regard to therapies of COPD

Evaluation of heat stimuli evoked responses in a postoperative pain model



Immunohistochemical staining of dopamine D1 receptor in human trachea. (A) Expression of dopamine D1 receptor on airway smooth muscle (ASM). (B) Negative control.

Craniofacial Engineering and Regeneration

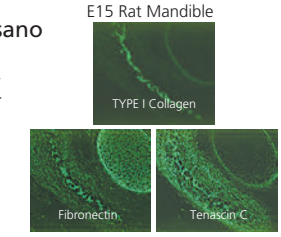
Craniofacial Development and Regeneration

Professor Yasuyuki Sasano

We have been investigating development, regeneration and healing of bones and teeth using rat experimental models. In particular, we are interested in regulatory mechanisms of extracellular matrices on cell and tissue differentiation in the calcified tissues.

◆ Main research themes

- Regulatory mechanisms of extracellular matrices on differentiation of osteoblasts, chondrocytes, cementoblasts and odontoblasts
- Remodeling of extracellular matrices in the calcified tissues during development, regeneration and healing
- Differentiation and maturation of cells and extracellular matrices in the calcified tissue during development, regeneration and healing
- Regulatory mechanisms of calcification



Expressions of extracellular matrix molecules in a rat embryonic mandible

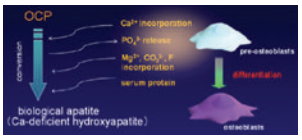
Craniofacial Function Engineering (CFE)

Professor Osamu Suzuki

We are focusing on the fundamental science and the applied research of tissue engineering with the biomaterial science and biology to investigate about regeneration of various bone defects in the fields of dentistry, oral surgery, and an orthopedic surgery. Especially, we are developing new functional biomaterials and new devices based on biomimetics.

◆ Main research themes

- Bone regeneration using the synthetic octacalcium phosphate (OCP), which is originally developed in our laboratory and becoming clear to be replaced to hydroxyapatite (HA) spontaneously when implanted in vivo
- Device development of the controlled release of the growth factors which reproduce bone and periodontal tissues
- Surface designing of the metal implants using calcium phosphates to increase bone regeneration capability and mechanical adaptability
- Elucidation of biomineralization and its application to bone regeneration using synthetic or natural polymer carriers
- Development of the drug and the gene delivery methods utilizing the synthetic calcium phosphates and translational research into bone regeneration field
- Micro-nano manipulation technology in cell culture and examination using tissue engineering methods
- Development of the method to evaluate bone quality of the regenerated bone tissue



The bone regeneration research using the originally developed artificial material (synthetic octacalcium phosphate (OCP)) to induce differentiation of osteoblastic cells and analysis of bone regeneration mechanisms.

Development of the culture device to load a mechanical stress on osteoblasts and chondrocytes. Analysis of stem cell differentiation process into osteoblasts and chondrocytes using the micro-nano manipulation technology.

Department of Community Medical Supports
(Tohoku Medical Megabank Organization)

Community Oral Health Science

Professor Akito Tsuboi

Progress of low fertility, high life expectancies and nuclear family tendency facilitates to reduce connectivity between members in a local community and family, and then to bring about a deterioration of functions for community. This weakened community function leads us to construct a sustainable health support system. Our division aims at clarifying a factor influencing to maintain and promote the oral and general health, based on a large-scale genome cohort study providing health, medical and genomic information of human as well as microbiome in the human body.

◆ Main research themes

- Construction of an oral health support system and program for the community
- Elucidation of oral health factors related to general health
- Genomics for oral health maintenance and promotion

Molecular Pathogenesis of Oral Tumor

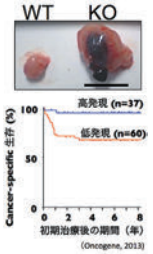
Oral Cancer Therapeutics

Professor Hisanori Horiuchi

Small GTPases function as molecular switches in cell proliferation, cell movement and intracellular traffic. We are investigating roles of small GTPases in oral cancer proliferation, invasion and metastasis. Bisphosphonates are used for the therapy of osteoporosis by inhibiting lipid modification of small GTPases in osteoclasts. We are also investigating about the posttranslational lipid modification.

◆ Main research themes

- Regulatory Mechanism of Oral Tumor Proliferation, Invasion and Metastasis by Small GTPases
- Research on Lipid Modification of small GTPases



We have discovered an inhibitory regulator of small GTPase Ral, RalGAP. In its KO mice, chemically induced bladder cancer were large and with high malignancy, compared to wild type (WT). Then, human bladder cancer with weak expression of RalGAP exhibited poorer prognosis compared to that with stronger expression. Thus, RalGAP could inhibit bladder cancer progression.

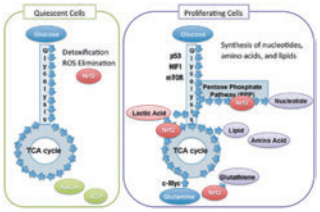
Molecular Oral Oncology

Professor Hozumi Motohashi

Squamous cell carcinoma (SCC) is the most common type of oral carcinoma. In many human cancers including SCC, aberrant activation of a transcription factor Nrf2 has been detected, which strongly correlates with the poor clinical outcome. We are working on the role Nrf2 plays in cancer cells. Our goal is to clarify the molecular mechanisms underlying the malignant evolution of cancers.

◆ Main research themes

- Roles of Nrf2 in Cancer Initiation and Promotion
- Stress Response Mechanism and Metabolic Reprogramming in Cancer Cells
- Intranuclear Redox Homeostasis and Genome Protection in Carcinogenesis



Nrf2 is a key regulator of cytoprotection against oxidative and xenobiotic stresses. In cancer cells, Nrf2 acquires the additional ability to enhance metabolic reprogramming and promotes cell proliferation.

Bio-Dental Engineering

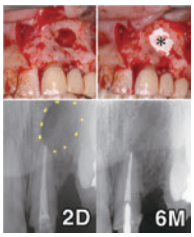
Bio-Dental Engineering

Professor Shinji Kamakura

Teeth are worked enough when the root of a tooth is surrounded by intact bone tissue. If the bone around the teeth were broken by suffering oral and dental diseases, such as periodontal diseases, congenital anomalies, and jaw tumors, several problems including masticatory disturbance would be evoked. The division aims to regenerate bone that was lost by oral and dental diseases with applying biomaterials, and recover the functional disturbances. Furthermore, the division has managed both basic and applied research with considering a low-burden treatment for patients.

◆ Main research themes

- Bone regeneration by octacalcium collagen composite (OCP/Collagen)
- Establishment of a new animal model for bone regeneration
- Research for quantification of regenerated bone tissue



Clinical application of OCP/Collagen (∗) after cystectomy: Radiopacity in the affected region at 2 days (2D) after implantation of OCP/Collagen is increased at 6 months (6M).

Intractable Diseases and Immunology

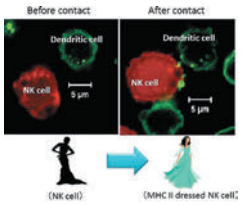
Intractable Diseases and Immunology

Professor Koetsu Ogasawara

Refractory systemic diseases often show initial lesions in the mouth. However, the relationship between intractable diseases and the onset of lesions in the oral cavity is not well understood. In our laboratory, we examine the immune responses related from oral diseases, to elucidate the pathogenesis of intractable diseases.

◆ Main research themes

- Dressed NK cell
- Viral immunity
- Immune surveillance against tumor
- Autoimmune diseases
- Metal allergy



MHC II dressed NK cells (Photo) NK cells (Red) acquire MHC II (Green) from Dendritic cells.

Advanced Biomaterials

Advanced Biocompatible Materials

Professor Takashi Goto

This laboratory is engaged to create novel bio-integrated materials and hybrid artificial tissues for hard tissue regeneration by developing physical/chemical surface modification processing.

◆ Main research themes

- Development of high strength, ductility and water-holding bio-integrated materials
- Development of surface modification processing to improve tissue cell adhesion with titan and hydroxyapatite
- Development of high cell adhesion, water/heat-holding and machinable hybrid artificial tissues

Advanced Biofunctional Materials

Professor Mitsuo Niinomi

Our department conducts research on the development of biomaterials with functionality similar to body tissues and promotes and activates gain-of-function of regenerated tissue.

◆ Main research themes

- Development of biofunctional materials such as dental implants and artificial bones harmonized with biofunction
- Development of biofunctional materials with mechanical and biological properties as well or better than those of body tissues
- Development of high functional materials supporting the biofunction lost by disease

Fig. X-ray photographs of fracture models made in tibiae of rabbits at 24 weeks after implantation of intramedullary rods made of low modulus titanium alloy (Ti-29Nb-13Ta-4.6Zr) and SUS316L stainless steel: Low modulus titanium alloy can suppress bone resorption, resulting in good bone remodeling.

Low modulus titanium alloy (Young's modulus ≒ 60GPa) SUS316L stainless steel (Young's modulus ≒ 160GPa)

Immune Regulation and Oral Immunity

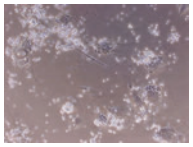
Immune Regulation and Oral Immunity

Affiliate Professor Satoshi Takaki

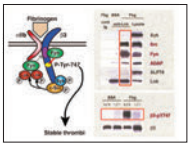
The oral mucosa is a front line of host defense system against microbes and hazardous antigens. It also becomes targets of inflammation caused by autoimmune or allergic responses. Immune regulation of oral immunity is critical issue to control infections and keep Quality of Life (QOL) of disease patients. We are investigating, 1) Signal transduction and regulation by microenvironments operating in the host defense system, 2) Mechanisms for the production of autoantibodies involved in the disease development and maintenance of autoimmune disorders including Sjögren syndrome, 3) Regulations for the maintenance and expansion of tissue stem cells, to manipulate and regulate immune responses in oral mucosa.

◆ Main research themes

- Signal transduction and regulation in humoral immune responses
- Mechanisms for the generation and function of auto-antibodies involved in various autoimmune diseases
- Development of methods for manipulating or reconstituting the immune system



Lymphocyte progenitor cells growing on bone marrow stromal cells



A newly identified regulation by Lnk adaptor protein in signaling through integrins

Geriatric Oral Science

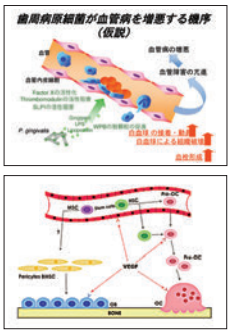
Geriatric Oral Science

Affiliate Professor Kenji Matsushita
Affiliate Professor Shumpei Niida

Japan has the highest longevity in the world. Maintaining the quality of life (QOL) of elderly is important for each individual and society. Our department conducts research on the molecular and cellular biology of bone and joint diseases (including alveolar bone and the temporomandibular joint) that lower the QOL of the elderly, and basic and clinical research on caries and periodontal disease causing tooth loss from the viewpoint of vascular biology and bone metabolism.

◆ Main research themes

- The role and application of nitric oxide in the periodontal tissue
- Diagnosis and control of the periodontosis
- Exploratory research of the aging and disease related biomolecule by Omics analysis



Relation of vascular and bone metabolism

Redox Regulation

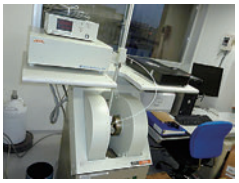
Laboratory for Redox Regulation

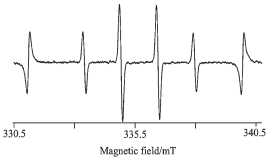
Professor Yoshimi Niwano

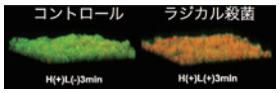
To elucidate in vivo behavior of reactive oxygen species (ROS) and free radicals accompanied by electron transfer in molecules that constitute living organisms such as lipid membranes, enzymes, and nucleic acids is an important subject in life science. In addition, control technology of ROS and free radicals is one of the important subjects in the medical field. In our laboratory, a wide range of research covering not only the medical field but the agronomy and engineering fields is conducted.

◆ Main research themes

- Basic and translational research on laser-excited radical disinfection technology
- Interaction of oxidative stress and antioxidants







Free radicals can be determined by using an electron spin resonance spectrometer.
Microorganisms in biofilms are effectively killed by the radicals.

Next generation Dental Materials Research

Next generation Dental Materials Research

Professor Keiichi Sasaki

In our research of dental equipment and materials, our aim is to deliver a healthy society for our ageing population by ensuring that diverse innovative new technologies that lead the way in the reform of clinical practice are promptly applied in the field of dentistry and used in clinical applications. We will analyze the basic technical properties of dental equipment and materials for reconstruction of lost teeth and bone tissue, and we will study the design, processing and biological safety of materials including their ability to function as intermediate materials. We will also develop mandatory test methods to ascertain the long-term durability of the materials themselves in the oral environment so that they can continue to function and maintain their shape when used *in vivo.*

◆ Main research themes

- Research of materials for dentures and dental restorative materials that can contribute to oral health care, and an evaluation of their technical characteristics

Liaison Center for Innovative Dentistry

Liaison Center for Innovative Dentistry

Center director Keiichi Sasaki

In the dentistry of a new century, the pioneering researches should be done by mutual collaboration with the researchers of other fields, and the contributions both inside and outside of the country are demanded. The Liaison Center for Innovative Dentistry promotes advanced dental research, interdisciplinary integration research, and industry/academic /government collaboration, and coordinates these research activities in the dentistry of a new century for realization of contributions within both regional and international society through educations, researches and clinics.

◆ Main research themes

- Promotion of international interdisciplinary integration researches regarding interface oral health science (Integration Research Section)
- Research and development for the new medical devices and biomaterials to realize healthy society of longevity (Integration Research Section)
- Research and education related to reconstruction after earthquakes, disaster prevention, and rehabilitation of Japan (Integration Research Section)
- Development and management of the curriculum for international cooperative education (International Cooperation Section)
- Development and operation of regional cooperative education, clinical supports, and social contribution programs (Regional Cooperation Section)
- Research of social capital within regional and international society (International Cooperation Section, Regional Cooperation Section)

Tohoku University Hospital

General Vice Director,
Tohoku University Hospital
Prof.
Takashi Sasano
(Oral Diagnosis)

Tohoku University Hospital and Tohoku University Dental Hospital were merged to become a united hospital in January 2010. The merger of the two hospitals was carried out to further advance research, education and clinical practice in the field of medicine and dentistry.

On average, 3000 outpatients and 1200 inpatients are treated at Tohoku University Hospital daily. About 600 outpatients visit the Department of Dentistry. Being one of the major large-scale hospitals in Japan, Tohoku University Hospital has a good reputation among local patients as well as those visiting from other areas in Japan and overseas. We promote development of cutting-edge medical technologies and original, steady research activities to ensure harmonization of patient-friendly medical care and advanced medicine. Recently established facilities and projects to promote clinical research include the Clinical Study Promotion Center (2012) and the Community Healthcare and Education Support Unit (2013).

Graduate students are paid for their clinical work at Tohoku University Hospital. An employment contract is signed between the students and the hospital to cover the former with occupational injury insurance and provide them with financial support. We encourage our students to take advantage of this opportunity.

After admission to the School of Dentistry, many graduate students will get a hands-on clinical experience at Tohoku University Hospital. We hope you will learn much from patients and become warm-hearted leaders of global dentistry/dental care and advanced specialists.

Tohoku University Hospital ····→ **Dental Division** →

Oral Health Enhancement

Preventive Dentistry
Orthodontics
Pediatric Dentistry
Occlusal Development

Oral Medicine and Surgery

Oral Diagnosis
Oral and Maxillofacial Surgery
Oral Anesthesia and Pain Management

Oral Reconstruction

Operative Dentistry
Endodontics
Fixed Prosthodontics

Oral Rehabilitation

Advanced Prosthetic Dentistry
Rehabilitation of Oral Function
Periodontics

Facilities for Specific Disorders

Comprehensive Dentistry
Maxillo-Oral Disorders
Prosthetic Geriatric Dental
Infection Control
Dentistry for Disabled
Maxillofacial Prosthetics Clinic

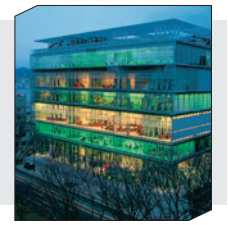
Sendai: the City of Trees.

Tohoku University is located in Sendai called the "City of Trees," Sendai is a great combination of beautiful greenery and urban sophistication and is also known as an academic city rich in culture and history.

HISTORY The quintessence of Date culture is still present

Surrounded by greenery and located along the Hirose River, Sendai used to be a castle town that yielded 3 million gallons of rice. Built by Masamune Date 400 years ago, Sendai still has the legacy of the Date Domain such as Sendai Castle, Zuiho-den and Rinno-ji Temple. It is also an academic town where a large number of students live. Apart from the museums, cultural activities at Sendai Mediatheque draw much public attention.

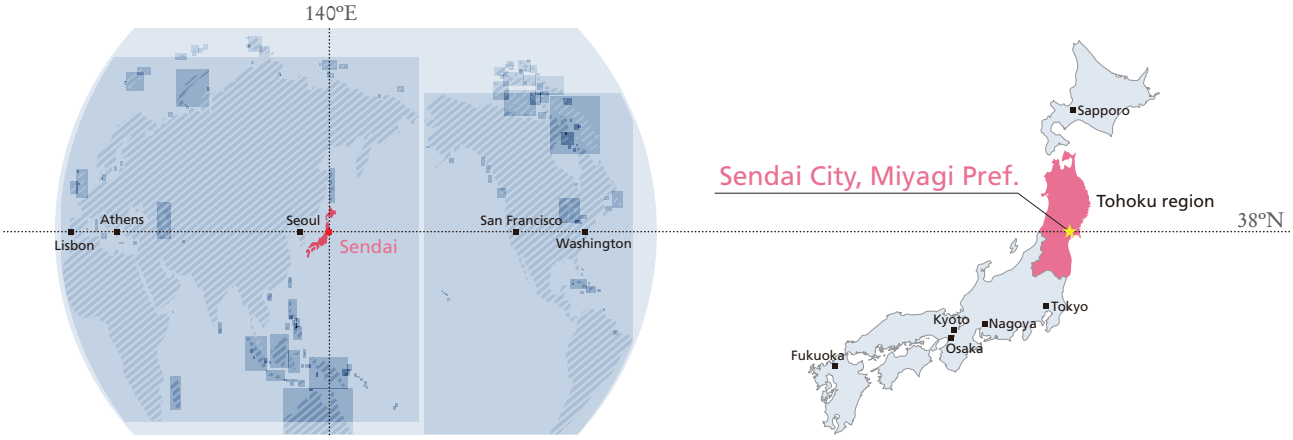
Photo credit: Tourist Division, Miyagi Prefectural Government



FESTIVALS Traditional festivals taking place throughout the four seasons

Popular festivals taking place in Sendai include the Aoba Festival with floats and dances, a heritage of Date culture, in spring; Sendai Tanabata Festival with paper art blowing in the breeze in summer; Jozenji Dori Jazz Festival that fills the streets with music in the fall; and in winter the Sendai Pageant of Starlight that feels as if it has come right out of a fairy tale.

Location of Tohoku University



Tohoku University
Graduate School of Dentistry

4-1 Seiryo-cho, Aoba-ku, Sendai, Miyagi Prefecture,Japan 980-8575
Tel: +81-22-717-8248 Fax: +81-22-717-8279
Website: www.dent.tohoku.ac.jp/english/ E-mail: international@dent.tohoku.ac.jp