






HOKKAIDO UNIVERSITY

Graduate School of Biomedical Science and Engineering

Guidebook for the Master's and Doctoral Programs

2020



INDEX

Goals of the Graduate School of Biomedical Science and Engineering

The Graduate School of Biomedical Science and Engineering features a new disciplinary direction integrating the biomedical science and engineering fields, aiming to apply the development of science and engineering to medical science, under the four basic principles adhered to by Hokkaido University: Frontier Spirit, Global Perspectives, All-round Education, and Practical Learning.

Biomedical Science and Engineering is a new field that aims to elucidate biological phenomena, overcome diseases, and promote the health of humans by utilizing knowledge and technology obtained in science and engineering.

Our Educational Goals Include Training for the Following Professionals:

- Professionals who will contribute to the sustainable development of human society with high-level specialty knowledge and an outstanding ethical perspective
- Professionals who will accommodate advances and internationalization in developing medical technology and equipment with extensive knowledge and strong research abilities

To Achieve Our Educational Goals, We Have Established the Following Two Courses:

- **Quantum Biomedical Science and Engineering Course**
  offering an opportunity to acquire a thorough knowledge as needed to apply basic radiation physics developed from quantum mechanics to medical science
- **Molecular Biomedical Science and Engineering Course**
  offering an opportunity to acquire a thorough knowledge as needed to apply science and engineering to *in vivo* molecules in medical science

In both courses, you can expect an innovative integrated education for the basic knowledge and skills in the fields of science and engineering as well as a basic education in medicine and medical ethics, systematically provided by all the members of the graduate school faculty.

Our Ideas for What Kind of Students We Wish to Enroll

We expect to enroll students who have strong interests in and curiosity about "biomedical science and engineering" as well as in the fields that form the basics of the courses (science, engineering, and medicine) and who are equipped with the solid educational foundations required for studies here. The students are also assumed to have aspirations to sincerely devote themselves to research by utilizing the knowledge and skills they acquire here, and work to contribute to the sustainable development of human society as specialists in biomedical science and engineering.

Organizational Chart of the Graduate School of Biomedical Science and Engineering

- Graduate School of Biomedical Science and Engineering
  Dean of the Graduate School of Biomedical Science and Engineering
  - Vice-dean
  - Faculty
  - Committees
  - Administration Office
- Division of Biomedical Science and Engineering
  - **Quantum Biomedical Science and Engineering Course** (See pp. 5-6)
    - Particle Beams for Biomedical Science and Engineering
      - Radiation Oncology
      - Radiation Medical Physics
    - Radiation for Biomedical Science and Engineering
      - Medical Applied Basic Physics
      - Medical Physics and Engineering
      - Clinical Medical Physics
  - **Molecular Biomedical Science and Engineering Course** (See pp. 7-8)
    - Biomedical Imaging
      - Medical Image Analysis
      - Integrated Molecular Imaging
      - Biomarker Imaging Science
    - Biology for Biomedical Science and Engineering
      - Molecular Oncology
      - Molecular and Cellular Dynamics Research

HOKKAIDO UNIVERSITY
Graduate School of Biomedical Science and Engineering

Message from the Dean

Dean of the Graduate School of Biomedical Science and Engineering, Hokkaido University

SHIRATO Hiroki

Society has a need for talented scientists who are able to apply innovative technology from science and engineering to medicine to assist in alleviating patient suffering brought about by diseases, through an understanding of the physiology of the human body and the pathology of diseases. The Graduate School of Biomedical Science and Engineering, Hokkaido University was newly established on April 1 of 2017 with the aim to train specialists who will be able to make such contributions. This will be the fourth year since its establishment.

Biomedical Science and Engineering is a new academic discipline designed to throw light on biological phenomena, to be able to deal with diseases, and through this to promote the health of humans by utilizing knowledge and technology gained through science and engineering. We aim to explore what is meant by life and human health, scientifically, to translate research results into advances in medicine, and assist in helping people worldwide to live peaceful lives. In the history of science and engineering it is 200 years since Dalton and Avogadro proposed their molecular theories, just 100 years since we discovered the quantum mechanics of Heisenberg, Schrödinger, and others, and it is only 70 years since "What is life?" was published by Schrödinger. As the complexity and difficulty faced by modern science and engineering increases, there is little doubt that the importance of this graduate school will become increasingly significant.

It is my wish that many of the students here will pursue medical problems using innovative science and engineering to become researchers pursuing development to apply innovative technology to medicine properly, and develop new medical technologies and equipment through collaboration with other medical professionals and industry. I also wish that their efforts will enable the prevention, diagnosis, and development of cures of as many incurable illnesses in our present age as is at all possible.

The graduate education provided here will be comprised of two courses: one is the Quantum Biomedical Science and Engineering Course, which applies radiation physics derived from quantum mechanics to medical science, and the other is the Molecular Biomedical Science and Engineering Course, which applies the science and engineering of *in vivo* molecules to medical science. In the Master's program, we will train experts who will contribute to society through medical physics and equipment development work related to radiology, with a thorough understanding of medical ethics. In the Doctoral Program, we will train outstanding specialists who will be able to play leading roles in international research with knowledge and skills that will enable them to become leaders in these areas.

Finally, I wish to express our gratitude for any advice, support, and encouragement you may be able to provide.

FEATURES OF THE GRADUATE SCHOOL OF BIOMEDICAL SCIENCE AND ENGINEERING

In the Graduate School of Biomedical Science and Engineering, we have established two courses to meet student interests and the needs of their future careers: The Quantum Biomedical Science and Engineering Course to acquire the in-depth comprehensive knowledge required to apply the basic radiation physics developed through quantum mechanics to medical science, and the Molecular Biomedical Science and Engineering Course to acquire the in-depth knowledge required to apply science and engineering to *in vivo* molecules in medical science. These courses are offered with unique curricula exclusive to our school.

Vice-dean
SHIMIZU Shinichi

Interdisciplinary Subjects / Course Work

- Lectures in interdisciplinary subjects for medicine, science, and engineering where students will acquire the basic knowledge and skills of these fields, in addition to a basic knowledge of medical science and medical ethics
- Productive course work for students with diverse backgrounds to complete the learning tasks systematically, ranging across multiple subject areas

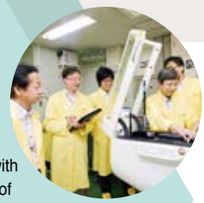
Global Perspectives

- World leading intensive lectures for education in medical physics and radiation biology in cooperation with internationally renowned universities and other relevant organizations

Support System for International Students

- At the Graduate School of Biomedical Science and Engineering, courses are provided in English in principle if international students attend the courses. Students can complete their programs only in English.
- Special selection for international students is conducted using Skype for those who have difficulty in visiting Japan for an entrance exam. (See p.9)

Methods of Education and Research for Career Development



- Customized opportunities for all students to be provided with individualized research support through the collaboration of the staff of the science, engineering, and medical faculties
- Hokkaido University Hospital in-house training in subjects for medical professionals and medical engineers who will play active roles in medical settings as medical physicists
- Subject curricula designed to train technical experts able to conduct research and development of medical equipment, including the quality control aspects, through actual innovative development of medical equipment in collaboration with industry

Developing Skilled Specialists with a Broad Comprehensive Understanding

- Subjects where students can acquire comprehensive medical-related industry-academia-government relevant knowledge, where it differs from standard science, engineering, and biology. This includes the historical background to biomedical science and engineering, the importance of statistics grounded in the diversity of life, medical economics, and medical administration including the development of medical equipment

Developing Specialized Personnel with High Ethical Standards

- The subjects we offer will develop high ethical standards and provide the ethical knowledge required, including the basics of medical ethics, guidelines for clinical research and conflicts of interest, knowledge which is required for “research related to human beings” when conducting research and development of medical technology and medical equipment

Message from a Student

First year doctoral student,
Quantum Biomedical Science
and Engineering course of the Graduate School
of Biomedical Science and Engineering

Completed the Department of Clinical Medical Physics of Hokkaido University Graduate School of Biomedical Science and Engineering in March, 2020 **SAITO Yuki**

Wishing to become a medical physicist

I learned about the profession of radiotherapy specialist, “medical physicist”, through a lecture in my undergraduate studies. Having been interested in radiation therapy, I thought it would be the profession for me, and enrolled in the Graduate School of Biomedical Science and Engineering, which offers a medical physicist program. This program encompasses a variety of studies, included diagnostic imaging, radiation physics, and processes for developing medical devices. Studies in the program were challenging and interesting because of the difficulty and because I had opportunities to interact with students from different fields. With the support of others around me, I realized my longed-for dream and passed the examination for medical physicist. To become a medical physicist, I also need clinical experience, and I plan to gain this experience in a doctoral program.
In the master’s course, I proposed improvements to Auto-Planning, which automatically optimizes the radiation treatment planning, and quantitative goals for the treatment planning. With this study we can improve the quality and efficiency of treatment planning.
For the future, I wish to engage in clinical work as a medical physicist to be able to perform high quality radiation treatment.

〈As of April 2020〉

History of the Graduate School of Biomedical Science and Engineering

Sapporo Agricultural College (1876)
(Hokkaido University Archives Collection)

August 14, 1876
- Establishment of Sapporo Agricultural College

October 1, 1947
- Change of name to Hokkaido University

Hokkaido University Medical Hospital (1961)
(Hokkaido University Archives Collection)

April 1, 1918
- Establishment of Hokkaido Imperial University

April 1, 2004
- Changed to become Hokkaido University, National University Corporation
- Establishment of an Endowed Chair and Funded Research Department for Real-time Tumor-tracking with Molecular Imaging Medicine in Hokkaido University Hospital

2008
- “Program for Medical Physicist and Quality Control Specialists” was established at the Graduate School of Medicine and School of Engineering

2009
- Decision to build and establish a Proton Beam Therapy Center at the Hokkaido University Hospital site

2012
- “Innovative Medical Physics Course” established at the Graduate School of Medicine and Graduate School of Science, Hokkaido University

April 1, 2017
- **Establishment of the Graduate School of Biomedical Science and Engineering, Hokkaido University**

2014
- Completion of construction of the Hokkaido University Hospital Proton Beam Therapy Center
- Establishment of GI-CoRE (Global Institution for Collaborative Research and Education), a faculty organization under the direct leadership of the president of Hokkaido University

Quantum Biomedical Science and Engineering Course

Students are expected to acquire a thorough knowledge of quantum biomedical science and engineering, which is necessary to be able to apply basic radiation physics knowledge developed from quantum mechanics to medical science, as well as specialized knowledge and skills in radiation therapy, particle therapy, and novel medical equipment related to these therapies. The training in this course will enable students to conduct international research, and play leading roles in the development of novel medical equipment and technology related to radiation and particle therapies.

Particle Beams for Biomedical Science and Engineering

Radiation Oncology

SHIRATO Hiroki,
Professor

SHIMIZU Shinichi,
Professor

NISHIOKA Kentaro,
Assistant Professor

Radiotherapy is characterized by the possibility of preserving the original functions of the living body and by maintaining the patient's ability to function through the induction of the disappearance of neoplasms/tumors, unlike surgery which treats cancer by the removal of organs/tissues from the body. X-ray radiotherapies and particle beam therapies with charged particles achieve treatment by utilizing the physical characteristics of these rays by means of state-of-the-art scientific/engineering technology. The development of more practically useful and effective devices and therapeutic techniques will be enabled if we view and discuss the frontier technology of engineering and science on the basis of a deep understanding of human body structure/function and medical/physiological viewpoints, focusing for example on dose concentration for the purpose of tumor control, dose reduction to normal tissues/organs to minimize adverse reactions and how to deal with body and organ movements that result from respiration, cardiac beating, peristalsis, etc. This laboratory aims to cultivate talented students who are capable of contributing to improvements in disease cure rates and quality of life (QOL) for patients with cancer and other diseases through research on technologies dealing with the motion of organs during radiotherapy, research on particle beam therapies and the development of new medical technology, as well as cultivating globally active researchers and educators on these topics.

Hokkaido University Hospital Proton Beam Therapy Center

Highlighted Keywords: innovative radiation therapy, medical physics for radiation therapy, image-guided, real-time tumor monitoring system

Radiation Medical Physics

TAKAO Seishin,
Assistant Professor

Following recent improvement in the outcome of treatment, thanks to advances in medical/scientific/engineering technology, the need to radiotherapy has been increasing remarkably. Among others, particle beam therapy, which applies accelerators to healthcare, is receiving much expectation as a means of minimizing the patient's physical stress through achieving dose concentration on the target cancer. Recently, the use of image guiding technology has made it possible to provide treatment in a way tailored to the patient's motions during treatment, morphological changes of the tumor, bioreactions and other factors. This laboratory is aimed at utilization of the technology of science/engineering (radiation physics, quantum beam applied engineering, image engineering, etc.) to healthcare. Specifically, in collaboration with the Hokkaido University Hospital Proton Beam Therapy Center, this laboratory will engage in development of irradiation technology/devices capable of reducing adverse events and improving therapeutic efficacy, development of image guiding technology incorporating detailed information about patient's motions and tumor's morphological changes, development of dose calculation/optimization techniques for realization of high precision treatment, and comprehensive education/research through links of medicine, science and engineering (verification of therapeutic efficacy, taking into account also the cellular level reactions, etc.). Through these activities, this laboratory will cultivate researchers of medical physics and engineers for medical device development.

Hokkaido University Hospital Proton Beam Therapy Center

Highlighted Keywords: particle therapy, real-time tumor-tracking technique, image guidance technique

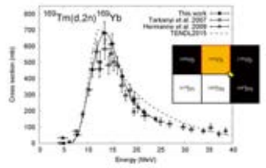
Radiation for Biomedical Science and Engineering

Medical Applied Basic Physics

AIKAWA Masayuki,
Professor

In medical fields, such as radiation therapy and particle therapy, a deep understanding of natural science, especially physics, can play an important role to solve problems and to develop new technologies. For example, the systematic study of nuclear reaction probabilities (cross sections) is required to accurately estimate necessary amounts of medical radioactive isotopes (RI) while minimizing unnecessary by-products. We focus particularly on charged-particle induced reactions using accelerators, and experimentally measure production cross sections of such RI. We train specialists to conduct research for the public from the physics point of view and to obtain new knowledge required for medical fields.

Metal foil used as target in experiments



Cross section of ^{169}Tm(d, 2n) ^{169}Yb

Highlighted Keywords: radioisotope, nuclear reaction, activation cross section

Medical Physics and Engineering

ISHIKAWA Masayori,
Professor

Although medical physics is an indispensable element for radiotherapy, it seems to be less mature in Japan than in other countries. In the United States, leading the world in terms of radiotherapy, each facility providing radiotherapy has medical physicists, who is in charge of quality control of radiotherapy and development of new radiotherapy techniques. In Japan, there is no sufficient environment for such active roles of medical physicists. Radiation measurement is a core technology not only for radiotherapy, but also diagnostic radiology and nuclear medicine. Expertise education on these topics is an element indispensable for cultivation of researchers in the field of medical physics and engineers engaged in development of radiotherapy devices. This laboratory will cultivate researchers and engineers capable of contributing to healthcare through development of clinically useful technologies, in collaboration with the Hokkaido University Hospital.

Radiation therapy system, real-time tumor monitoring system

Highlighted Keywords: dosimetry, radiation treatment planning devices, research and development of new algorithm, quality assurance technology

Clinical Medical Physics

HASHIMOTO Takayuki,
Associate Professor

SUZUKI Ryusuke,
Assistant Professor

TAMURA Masaya,
Assistant Professor

New discovery for the next generation can be achieved if problems with clinical practice are viewed as research seeds and attempts are made to find solution to such problems through utilization of the knowledge/skills of science and engineering while adhering to the medical ethics. To this end, students will carry out research in areas closer to a hospital, and confirm the ideas arising from such research through experiments, simulation, etc. at our laboratory, followed by translational research in collaboration with the industry, towards the goal of acquiring research capabilities leading to development of medical devices. During the course of such activities, students acquire the capabilities needed for medical physicists. In this way, talents capable of contributing to the society will be cultivated.

Radiation therapy device and medical physics staff, Hokkaido University Hospital

Highlighted Keywords: clinical medical physics, real-time tumor monitoring, radiation treatment planning

Molecular Biomedical Science and Engineering Course

Students are expected to acquire a thorough knowledge of molecular biomedical science and engineering, necessary to apply science and engineering to *in vivo* molecules in medical science, as well as have specialized knowledge and skills in molecular imaging diagnostics, molecular biology, and radiation biology. The training in this course will enable students to conduct international research, and play leading roles in international research and development projects of new molecular image diagnostic equipment and drugs, oncolytic virotherapy, and radiation sensitizers.

Biomedical Imaging

Medical Image Analysis

KATOH Chietsugu,
Professor

This laboratory involves research on computerized processing of images yielded from nuclear medicine tests (PET, SPECT (Single Photon Emission Computed Tomography)), CT, MRI and so on aimed at precisely collecting medical information from such visual data. Regarding tumor images, research is made on estimation of tumor malignancy and volume, estimation of the periphery of lesions, estimation of appropriate range of irradiation, correction of artifacts on images arising from respiratory motions and cardiac beats, and so on. Regarding images of myocardium and brain, compartment model analysis is carried out on serial dynamic images following a dose of contrast material or radioisotope for the purpose of quantitative evaluation of ischemic lesions and quantitative analysis of tissue blood flow, oxygen consumption, etc. Artificial Intelligence technology with deep learning is also adopted for analyzing medical image data. Talents capable of developing programs for achievement of these goals will be cultivated.

Discussion about quantitative analysis for blood flow and oxygen consumption in tissue

Highlighted Keywords: medical image analysis, nuclear medicine examination, compartment model analysis, deep learning

Integrated Molecular Imaging

KUGE Yuji,
Professor

HIRATA Yuichi,
Associate Professor

MIZUNO Yuki,
Assistant Professor

For realization of diagnostic molecular imaging, it is indispensable to develop a probe (molecular probe) for conversion of molecular information of the living body into measurable signals. This laboratory is aimed at developing clinically applicable molecular imaging technology through research of new molecular probes, i.e., through exploration of functional molecules, designing of probes, development of probe synthesis technology and synthesis devices, and translational research for clinical application. In addition, through these research and development activities, this unit will guide students to acquire necessary knowledge/skill systematically so that they can contribute to healthcare and society.

Members of Laboratory of Integrated Molecular Imaging.The person shown on the display is a graduate student staying in Tokyo.

Highlighted Keywords: molecular imaging diagnostics, molecular probe design, molecular probe synthesis technology

Biomedical Imaging

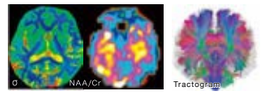
Biomarker Imaging Science

Khin Khin Tha,
Associate Professor

Kenneth Sutherland,
Assistant Professor

Significant efforts have been/ are being paid to achieve "Personalized Medicine". Non- or less invasive imaging techniques such as MRI and CT are extensively used in selection of treatment methods, treatment planning and prediction/assessment of responses to treatment. This laboratory is carrying out researches that target at the development of high resolution and precision imaging diagnostics — which (i) pose little burden on patients, (ii) enable noninvasive detection of early subtle changes of the living body, and (iii) reflect not only morphological information but also the information on physiological changes of the body at cellular/molecular level. Education on normal radiologic anatomy and diagnostic radiology making use of these imaging techniques will also be provided.

An MRI examination



Non-invasive quantitative images with MRI

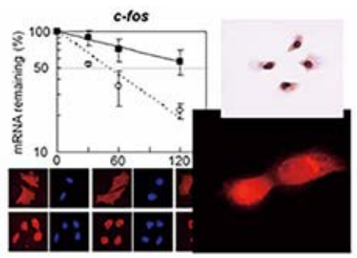
Highlighted Keywords: biomarker imaging science, high precision imaging diagnostics, CT, MRI

Biology for Biomedical Science and Engineering

Molecular Oncology

HIGASHINO Fumihiro,
Associate Professor

Correct understanding of the mechanism for carcinogenesis at the molecular level is necessary for sufficient control of cancer, the leading cause of death among Japanese people. Such understanding is indispensable for development of new cancer diagnosis/treatment methods. In recent years, thorough analysis of RNA including non-coding RNA has been advanced after the end of genome project, and the diverse relationships between carcinogenesis and RNA have been revealed increasingly. At this laboratory, new mechanisms for carcinogenesis are explored on the basis of molecular biological analysis covering RNA, viruses, etc., and systematical education/research, ranging from basics to applied one, will be provided concerning development of new cancer diagnosis/treatment methods making use of the findings from such exploration.



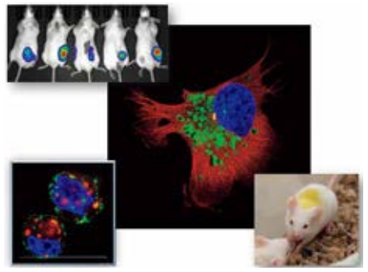
Molecular biological analysis of RNA and RNA-binding protein in cancer cells

Highlighted Keywords: molecular biological analysis, development of new methods of diagnosis and therapies to deal with cancer

Molecular and Cellular Dynamics Research

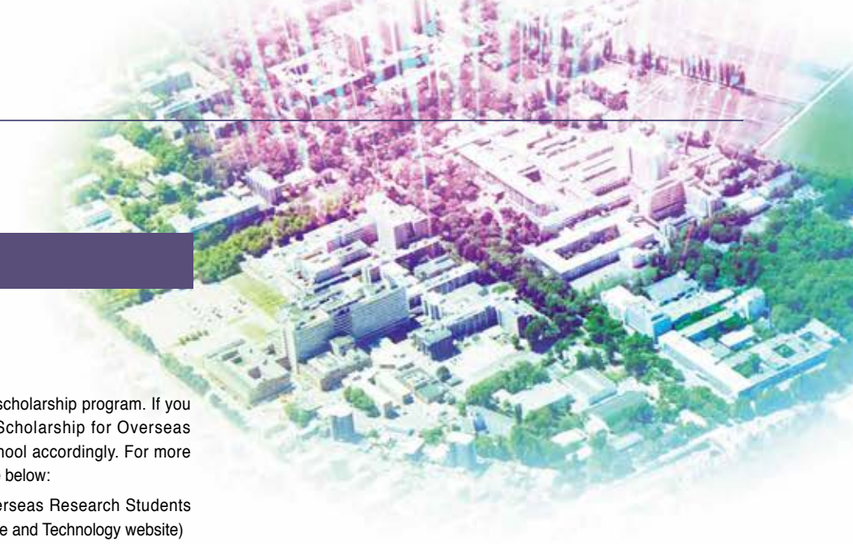
Jin-Min Nam,
Lecturer

Radiation therapy is commonly used for treatment of cancer. However, the radiation effects and its molecular mechanisms on cancer or normal tissues still remain elusive. We have been investigating the acquisition process and molecular mechanisms of invasiveness on cancer cells in the presence of stress such as radiation considering three-dimensional cell structure and microenvironment using the experiment techniques of molecular biology, cell biology and biochemistry. Through the research program, we train students to be world-leading scientists and educators with great expertise in cancer research and experimental techniques.



Cancer research using cell and animal models

Highlighted Keywords: cancer invasion, vesicle trafficking, extracellular microenvironment, radiation biology



Overview of the Program

Master's Program

■ **Standard length: two years**
Long-Term Study: Working students may take up to four years, paying tuition for two years only.

■ **Completion requirements**
- study in the graduate school for at least two years
- having earned at least 30 assigned credits
- having received the required research instruction, master's thesis accepted, and passing an examination

■ **Degree awarded**
Master's degree (in Biomedical Science and Engineering)

Doctoral Program

■ **Standard length: three years**
Long-Term Study: Working students may take up to six years, paying tuition for three years only.

■ **Completion requirements**
- study in the graduate school for at least three years
- having earned at least 10 assigned credits
- having received the required research instruction, doctoral thesis accepted, and passing an examination (at least one basic research paper as the first author has been submitted to an English-language journal)

■ **Degree awarded**
Doctor (in Biomedical Science and Engineering)

Notes (Master's and Doctoral Programs)

■ **Scholarship information**
The graduate school does not have its own scholarship program. If you wish to apply for Japanese Government Scholarship for Overseas Research Students, inform the graduate school accordingly. For more information on the system, refer to the website below:

Japanese Government Scholarship for Overseas Research Students (Ministry of Education, Culture, Sports, Science and Technology website)
http://www.mext.go.jp/a_menu/koutou/ryugaku/06032818.htm

■ **Educational programs**
In addition to the regular curriculum, the graduate school provides the Medical Physics Educational Program (including the Rare/Pediatric Cancer Biomedical Science and Engineering Program) and the Medical Device Development Program (only master's program). A diploma is granted to those who have completed the programs (See p.11).

Fees	● Examination fee: 30,000 Yen ● Admission fee: 282,000 Yen ● Tuition fee: 535,800 Yen (per year) There may be cases where the admission and tuition fees are changed.

Approach and Steps to the Entrance Examination and Screening Test (Master's/Doctoral Programs)

① August Examination, 2020 ② January Examination, 2021 ③ Special Selection for International Applicants, 2020
Note: The examination ② may not be conducted depending on the outcome of the examination ① .

● **Admission number**
(Including those separately enrolled as working students)
① Master's Program：12 / Doctoral Program：5 (For enrollment October 2020 or April 2021)
② Master's / Doctoral Programs：A few (For enrollment April 2021)
③ Master's / Doctoral Programs：A few (For enrollment October 2020)

● **Application periods for master's and doctoral programs**
① July 20 (Monday) to July 28 (Tuesday), 2020 (Submit application documents)
② December 10 (Thursday) to December 16 (Wednesday), 2020 (Submit application documents)
③ June 10 (Wednesday) to June 12 (Friday), 2020 (Apply using the application website)

Hours applications are accepted: 9 a.m. to 5 p.m. If you send the application from by mail, send it as an express registered letter, and make sure it is delivered by the deadline.

● **Dates of entrance examinations for master's and doctoral programs**
① August 25 (Tuesday), 2020
② January 26 (Tuesday), 2021 (tentative)
③ June 30 (Tuesday) to July 6 (Monday), 2020

● **Examination type (Master's/Doctoral Programs)**
① or ②
- Essay Examination
- Oral examination

③ Internet video (skype) interview

Note(① ② ③): Foreign language proficiency will be evaluated by TOEFL or TOEIC scores in addition to the exams described above. Please submit scores for TOEFL or TOEIC.

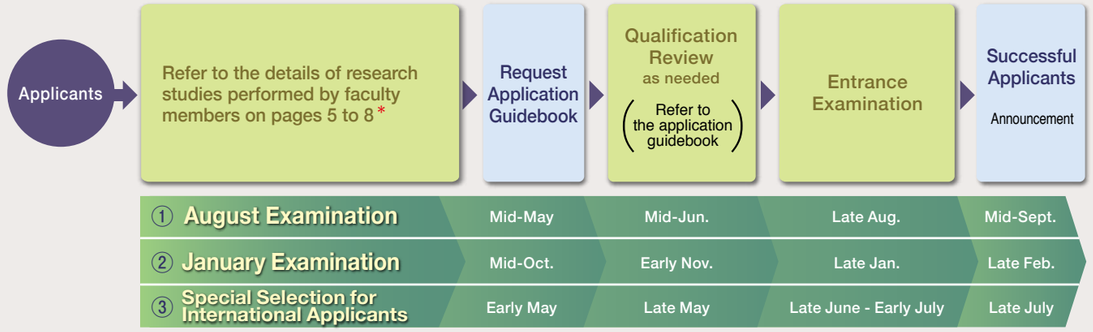
● **Eligibility to apply**
- **Master's program**

① or ② Those who have graduated or are expected to graduate from a university by March, 2021.
Those who deemed by our graduate school under individual qualification review as possessing academic ability equivalent to or greater than university graduates and will be 22 years of age or older by March 31, 2021, etc.
③ Those who meet one of the above requirements and cannot arrive in Japan during the date of examination designated by the Graduate School and those who can obtain consent from the prospective supervisor prior to application.

- **Doctoral program**

① or ② Those who have been awarded or are expected to be awarded a master's degree or professional degree by March 31, 2021.
Those who deemed by our graduate school under individual qualification review as possessing academic ability equivalent to or greater than master graduates or individuals possessing a professional degree and will be 24 years of age or older before March 31, 2021, etc.
③ Those who meet one of the above requirements and cannot arrive in Japan during the date of examination designated by the Graduate School and those who can obtain consent from the prospective supervisor prior to application.

【 Examination Process Flowchart 】



＊ **Finding a faculty member who hosts international students**

1) Using Details of Laboratories and List of Faculty on the Graduate School of Biomedical Science and Engineering website for reference to search for a desired faculty member.
(A mismatch between the research of the faculty member and the desired research of the student sometimes occurs. Check the website and papers written by the faculty member carefully.)

2) Contact the graduate school
Send your Curriculum Vitae and previous studies as well as details of your desired research, study plan and faculty member to the Student Affairs Office of the Graduate School of Biomedical Science and Engineering by e-mail (d-tanto@med.hokudai.ac.jp).
Please visit the website below to get the form of Curriculum Vitae.
URL: https://www.med.hokudai.ac.jp/en/bme/international-students/index.html

Note: For further details, please make sure to check the application guidelines on the website below:
https://www.med.hokudai.ac.jp/en/bme/admissions/index.html

Medical Physics Educational Program

■ What is a Medical Physicist?

A medical physicist in Japan is a medical professional who contributes to medical care from the standpoint of a specialist in medical physics by ensuring that medical care involving radiation is properly performed. In radiotherapy, medical physicists optimize treatment plans working with physicians, and conduct quality control and verification of the actual medical application working in concert with physicians, clinical radiological technologists, and radiotherapy quality control specialists. Medical physicists also confirm the accuracy of the position and doses administered to the patient body, ensuring that they are within the clinically required range, and that the treatment is performed as prescribed by the physicians. They also engage in medical physics research and development related to radiotherapy. For matters related to diagnosis and nuclear medicine, they work with physicians, ensure the maintenance of a clear balance between effectiveness and safety of diagnoses, and conduct quality control and verification of the diagnostic apparatus and images, working in concert with the clinical radiological technologists. They also engage in medical physics research related to diagnostic radiology.
As of April 1, 2020, 1,228 medical physicists have been certified in Japan by the Japanese Board for Medical Physicist Qualification, and they are actively working in various fields including education, research, clinical settings, and research and development in industry.

Staff of the Medical Physics Educational Program
SUZUKI Ryusuke
(Specialized in Clinical Medical Physics / Medical Physicist)

■ About the Program

This has been accredited as a medical physics education course that meets lecture/clinical standards complying with the education curriculum guidelines set by the Japanese Board for Medical Physicist Qualification (JBMP). Those who have completed this course are given preferential treatment in gaining certification as a medical physicist.
The program includes the Master's Program, the Combined Master's and Doctoral Program and the Doctoral Program. The medical physicist examination is conducted in Japanese.
For more information about the curriculum, please refer to this page (https://www.med.hokudai.ac.jp/en/bme/medical-physicists.html) on our website. And for further information about medical physicist examinations and accreditation as a medical physicist, please refer to the website of the JBMP (http://www.jbmp.org/english/).

Medical Device Development Program (Master's program only)

This program aims to train scientists who will be engaged in research and development mainly on diagnostic and therapeutic equipment using radiation. With the educational curriculum designed for acquiring advanced engineering knowledge, students must learn basic subjects related to the characteristics and functions of the human body as well as subjects related to biomedical engineering such as the influence of radiation on the human body, this knowledge is necessary for research and development of medical equipment. Students also have to learn applied subjects related to designing medical equipment, and handling of medical images and information. A "Certificate of Completion of the Medical Device Development Program" will be awarded to successful students.
Please contact the academic affairs section of the graduate school (d-tanto@med.hokudai.ac.jp) for detailed information about the program.

Message from a Medical Physicist

Qualification as Medical Physicist is Required for Radiotherapy

There has been an increase in the demand for medical physicists for treatment planning and quality assurance to ensure safe radiotherapy treatments as well as the development of the therapeutic and diagnostic fields.
I decided to obtain the qualification, wishing to be engaged in treatment from both the medical and physical standpoints. In this medical physics course, I was able to acquire the knowledge and skills necessary for the qualification, through lectures and clinical training in medical physics, and I obtained the qualification during my studies.
In recent years, the qualification has been a requirement to be able to work as a medical physicist in hospitals providing advanced radiotherapy such as IMRT and particle beam therapy. I think that the need for staff having this qualification will increase as these treatments develop and become more commonly available. The knowledge acquired while studying for the qualification was also useful in my research (dose simulation) at the graduate school and postdoctoral period in Netherlands Cancer Institute.
I recommend you to obtain the qualification as medical physicist by studying at the medical physicist courses here.

〈As of April 2020〉

Medical physicist, Department of Medical Physics, Hokkaido University Hospital
Division of Medicine (Doctoral Program), Hokkaido University Graduate School of Medicine (graduated in March, 2017)
KANEHIRA Takahiro

Messages from International Students

The following are the messages from students who completed the master's program in fiscal 2018 and international students currently enrolled.

2nd-year Doctoral Student
Molecular Biomedical Science and Engineering Course, Department of Medical Image Analysis
TSOODOL Zolbadral
【Mongolia】

To develop professional skills in a world-class research environment.

I am from Mongolia and a doctoral course student at the Graduate School of Biomedical Science and Engineering (BME), Hokkaido University. This university has a unique program that allows us to study a wide variety of knowledge in different fields, such as medicine, engineering, and basic sciences in collaboration with staff on the latest facilities and using innovative technologies.
As an illustration of the multidisciplinary research activity at BME, Hokkaido University, I would like to point to my research topic which focuses on the production routes for crucial medical isotopes and radioactive nanoparticles, used for advanced techniques such as PET, SPECT, and multimodality imaging in the medical diagnostic sector. As a part of the research, I am engaged in nuclear reaction experiments to measure the produced cross-section of medical isotopes from charged particle accelerators.
Finally, I recommend you not to miss a great opportunity to develop professional skills and to carry out high-level research in the world-class research environment at this university.

〈As of April 2020〉

3rd-year Doctoral Student
Molecular Biomedical Science and Engineering Course, Department of Molecular Oncology
Hossain Elora
【People's Republic of Bangladesh】

My research work makes me enthusiastic to learn and explore more

I've decided to pursue a postgraduate degree as a result of finding research motivating, innovative and challenging during my master's program. I came to Hokkaido University for its worldwide impact, and was interested in working with my supervisor Dr. Fumihiro Higasino, for genetically engineered oncolytic virus and for work in the molecular oncology program. As Japan is culturally rich and devoid of any kind of racism, this pulled me to enjoy having a collaborative environment.
I am working with a newly developed oncolytic adenovirus, which is genetically engineered for enhancing its efficacy. I am also working with some combination approaches like chemotherapy and radiation.
Hopefully I will be able to contribute something valuable to society after pursuing my PhD. My research work makes me enthusiastic to learn and explore more. I will definitely continue my learning.
There are many amazing aspects of BME; continually learning, exploring and interacting with interesting and talented people is a great privilege. Beside people here are very welcoming and helpful.

〈As of April 2020〉

Messages from the Former/Graduated Students

Engineer, Dept. of Nuclear Business, Hokkaido Electric Power Co.,Inc.
March 2019 graduate of Master's degree program
ICHIKAWA Seiya

A quest for potentially superior abilities

I started research into artificial intelligence (AI) after I enrolled in the Graduate School of Biomedical Science and Engineering. The research I was engaged in is a technique to automatically identify tumor sites in brain images using AI. I expect this technique will shorten the time spent on diagnosis, and reduce the burden on extremely busy physicians.
I have spent school life on a variety of classes such as radiation, patent application, and image analysis as well as my research activities. While studying at the graduate school, I came to wish to work in the nuclear power generation field. By integrating the knowledge of radiation gained from the medical field and the knowledge in the field of nuclear energy that I will learn in the future, I look forward to seeing how knowledge about radiation changes.
Even if you have no clear future vision like me in the past, you can identify your aptitude and find a goal you want to challenge. Why don't you quest for your potential ability?

〈As of April 2019〉

2nd-year Doctoral Student
Molecular Biomedical Science and Engineering Course, Department of Molecular and Cellular Dynamics Research
March 2019 graduate of Master's degree program
NISHIOKA Soichiro

Study cancer cells to enhance therapeutic effect

I learned molecular and cell biology at undergraduate school, and then entered the Graduate School of Biomedical Science and Engineering to do research related on cancer treatment. Radiotherapy is widely used for the treatment but some cancer cell types have resistance to radiation treatment. Why are they resistant to radiation? To investigate the question, I have studied molecular mechanisms on the radiation tolerance of cancer cells. This field still has many wonders, so it's very interesting.
We are under an excellent environment supported by faculty members who are enthusiastic in research and education. My skills of research and communication were fostered in master's program, and I have been advancing my research in the doctoral program. I wish to contribute to the progress of cancer treatments in the future.
If you are interested in, why don't you visit our laboratory?

〈As of April 2020〉

Main entrance of Graduate School of Biomedical Science and Engineering

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HOKKAIDO UNIVERSITY

CAMPUS MAP

Related Facilities

1 Faculty of Medicine, Northeast Research Bldg.
(Radiation Oncology / Clinical Medical Physics)

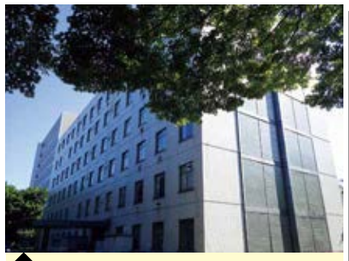
2 Faculty of Engineering, Q Bldg. / N Bldg.
(Radiation Medical Physics)

3 Faculty of Science, Main Bldg.
(Medical Applied Basic Physics)

4 Faculty of Health Sciences, A Bldg.
(Medical Physics and Engineering / Medical Image Analysis)

5 Central Institute of Isotope Science, South Bldg.
(Integrated Molecular Imaging)

6 Hokkaido University Hospital, Central Clinical Bldg.
(Biomarker Imaging Science)



7 Faculty of Dental Medicine, C Bldg.
(Molecular Oncology)

8 Faculty of Medicine, Central Research Bldg.
(Molecular and Cellular Dynamics Research)

9 Hokkaido University Hospital, Proton Beam Therapy Center

10 Student Affairs Office, Graduate School of Biomedical Science and Engineering
* Enter the main entrance and turn right at the first corner.

ACCESS [Access to the Sapporo Campus]

Subway

- Kita 12-jo Sta. (Namboku Line) ……10-min. walk
- Kita 18-jo Sta. (Namboku Line) ……10-min. walk
- Kita 13-jo Higashi Sta. (Toho Line) ……15-min. walk

Bus

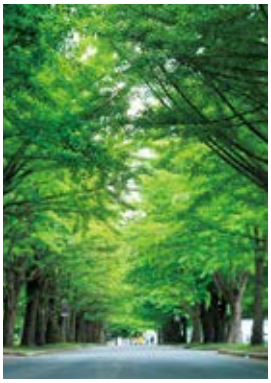
- From the Kitaguchi of the JR Sapporo Sta.
  Any of Chuo Buses 01・03・04 of the Tonden line
  Get off at the Hokudai Byoin Mae stop: 3-min walk

JR (Railway)

- From JR Sapporo Sta. : 20-min. walk

New Chitose Airport to JR Sapporo Station

- 40-min. by JR
- 80-min. by bus



HOKKAIDO UNIVERSITY
Graduate School of
Biomedical Science and Engineering

HOKKAIDO UNIVERSITY

Graduate School of Biomedical Science and Engineering

Guidebook for the Master's and Doctoral Programs 2020

Inquiries

〈 Inquiries about Admission 〉

Student Affairs Office,
Graduate School of Biomedical Science and Engineering, Hokkaido University

Kita15, Nishi7, Kita-ku, Sapporo, 060-8638, Japan
TEL：+81-(0)11-706-5523/5526　FAX：+81-(0)11-717-5286
d-tanto@med.hokudai.ac.jp

〈 Inquiries about Careers and Other Issues 〉

Career affairs faculty, Graduate school of
Biomedical Science and Engineering, Hokkaido University

radonc@med.hokudai.ac.jp

Graduate School of Biomedical Science and Engineering, Hokkaido University　Search

https://www.med.hokudai.ac.jp/en/bme

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