






HOKKAIDO UNIVERSITY

Graduate School of Biomedical Science and Engineering

Guidebook for the Master's and Doctoral Programs

2023




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Graduate School of Biomedical Science and Engineering, Hokkaido University　Search

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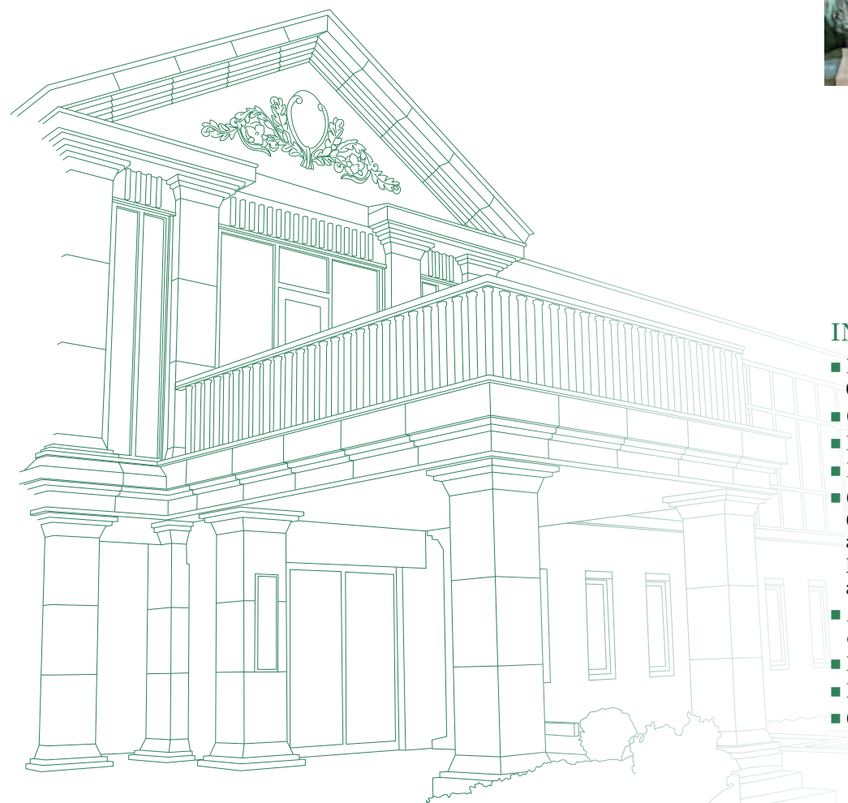

2023.4.21

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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

KUGE Yuji

Biomedical science and engineering is an academic discipline to elucidate life phenomena, overcome diseases, and improve human health by utilizing the knowledge and technology of science and engineering in medicine. The Graduate School of Biomedical Science and Engineering at Hokkaido University was established on April 1, 2017 with the aim of developing professionals capable of practicing biomedical science and engineering. The graduate school is comprised of (1) the Quantum Biomedical Science and Engineering Course to develop professionals who can apply specialized knowledge and skills of radiotherapy and particle beam therapy and related medical equipment to medicine, and (2) the Molecular Biomedical Science and Engineering Course to develop professionals who can apply specialized knowledge and skills of analysis and diagnostic imaging of in vivo molecular behavior to medicine.

Medical progress can only be achieved by combining not only the results of medical research but also the results of various studies in science, engineering and other fields with the development of science and technology. Needless to say, radiology requires engineering research and the development of radiodiagnosis and radiotherapy equipment. Nuclear medicine diagnostic imaging, including PET examinations, also requires engineering research on diagnostic imaging equipment as well as many physical and chemical studies such as nuclear physics/chemistry related to the production of radionuclides and synthetic chemistry/pharmacy related to the production of radiopharmaceuticals. Faculty members in a variety of research fields, including not only medical fields specializing in radiology but also science fields specializing in nuclear physics, molecular biology, radiobiology and pharmaceutical science, and engineering fields specializing in radiodiagnosis and radiotherapy equipment are involved in the educational and research activities at this graduate school. I believe this is the best environment for engaging in biomedical science and engineering education and research, which is focused on utilizing the knowledge and skills of science and engineering in medicine to elucidate life phenomena, overcome diseases, and improve human health.

I hope students who have studied biomedical science and engineering at this graduate school will play a leading role in Japan and the world as well as contribute to society and medical care through research on cutting-edge science and engineering applied to medicine, and development research of new medical technology and equipment. We look forward to your continued support and encouragement.

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.

Global Perspectives

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

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

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

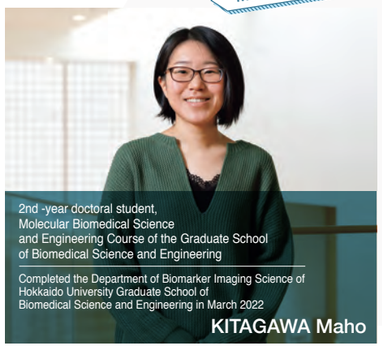
Developing Skilled Specialists with a Broad Comprehensive Understanding

- 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



2nd -year doctoral student,
Molecular Biomedical Science
and Engineering Course of the Graduate School
of Biomedical Science and Engineering

Completed the Department of Biomarker Imaging Science of Hokkaido University Graduate School of Biomedical Science and Engineering in March 2022

KITAGAWA Maho

Attracted by the research content

My entry into the Graduate School of Biomedical Science and Engineering was triggered when I visited my current supervisor’s laboratory during my senior year of college. She introduced me to her research on the calculation of quantitative indicators from diagnostic images to reflect the state and prognosis of diseases. It had never before occurred to me to use numbers when assessing images, which are normally assessed visually, i.e., qualitatively, so I was fascinated and wanted to learn more about it.

Since entering the school, I have been conducting research on the quantitative analysis of MRI images and evaluation of such a system. In the master’s degree program, I performed the quantitative evaluation of the MRI images of glioma and demonstrated the possibility of predicting the presence of prognosis-reflecting genes from MRI images showing amide groups in tissues. In my current doctoral work, I am evaluating the effects of nocturnal awakening on the brain of healthy subjects using MRI.

I wish to contribute to the development and advancement of medical imaging technology based on the knowledge of quantitative analysis of images that I am learning at the school.

History of the Graduate School of Biomedical Science and Engineering

Sapporo Agricultural College (1876)

August 14, 1876
- Establishment of Sapporo Agricultural College

October 1, 1947
- Change of name to Hokkaido University

Hokkaido University Medical Hospital (1961)

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 the Graduate School of Engineering

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

Hokkaido University Hospital, Proton Beam Therapy Center

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

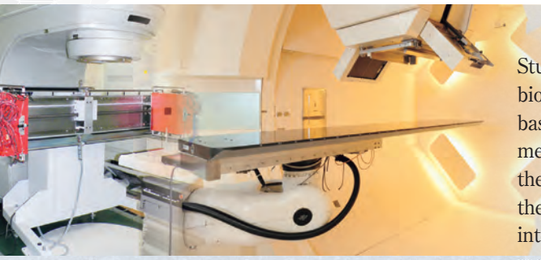
2014
- Completion of construction of the Hokkaido University Hospital Proton Beam Therapy Center
- Establishment of GI-CoRE (Global Institution for Collaborative Research and Education), a faculty organization under the direct leadership of the president of Hokkaido University

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

Real-time-image Gated Proton Therapy

April 1, 2020
- Internalized the Global Station for Quantum Medical Science and Engineering of GI-CoRE into the Global Center for Biomedical Science and Engineering, Faculty of Medicine

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

HASHIMOTO Takayuki,
Associate Professor

KOBASHI Keiji,
Specially Appointed Associate 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.

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

Radiation Medical Physics

TAKAO Seishin,
Associate Professor

YOKOKAWA Kohei,
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

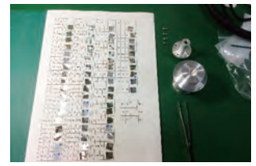
Highlighted Keywords: particle therapy, real-time tumor-tracking technique, image guidance technique

Radiation for Biomedical Science and Engineering

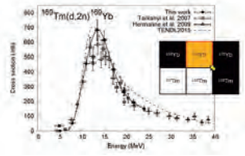
Medical Applied Basic Physics

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

NAKAMOTO Takahiro,
Assistant 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

SUZUKI Ryusuke,
Assistant Professor

TAMURA Masaya,
Assistant Professor

KANEHIRA Takahiro,
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. 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, towards the goal of acquiring research capabilities leading to future radiotherapy and 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, intensity modulated radiation therapy, proton therapy, real-time tumor tracking, radiation treatment planning

Molecular Biomedical Science and Engineering Course

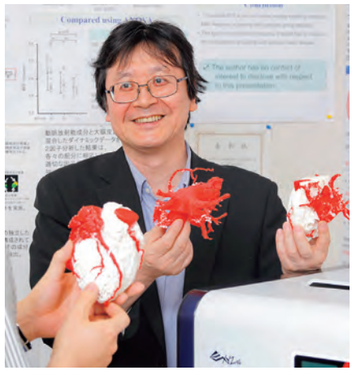
Students are expected to acquire a thorough knowledge of molecular biomedical science and engineering, necessary to apply science and engineering to *in vivo* molecules in medical science, as well as have specialized knowledge and skills in molecular imaging diagnostics, molecular biology, and radiation 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

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.
This laboratory is also actively conducting research on linking diagnostic molecular imaging technology to accurate treatment, that is, precision medicine and theranostics. 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 health-care and society.

Prof. Kuge and Assistant Prof. Mizuno in front of PET・SPECT・CT for animal researches.

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

Biomedical Imaging

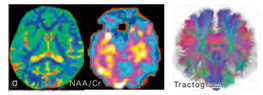
Biomarker Imaging Science

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

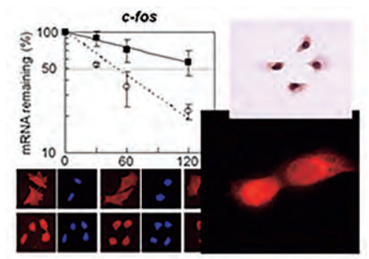
Highlighted Keywords: biomarker imaging science, high precision imaging diagnostics, CT, MRI

Biology for Biomedical Science and Engineering

Molecular Oncology

YASUDA Motoaki,
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.



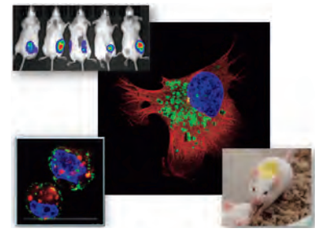
Molecular biological analysis of RNA and RNA-binding protein in cancer cells

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

Molecular and Cellular Dynamics Research

ONODERA Yasuhito,
Associate Professor

Radiation therapy is commonly used for treatment of cancer as one of the three major treatment modalities. However, as the underlying mechanisms for malignant properties of cancer cells are diverse and variable, the radiation effects and its molecular mechanisms on tumor and surrounding normal tissues still remain elusive. We have been investigating mechanisms inducing/suppressing the cell death in cancer cells, and the resulting unfavorable effects in tumors, which take place under the environmental stresses induced by therapy including radiation and also by cancer cells themselves. We especially focus on the roles of the three-dimensional cell/tissue structures, extracellular microenvironment, cell-cell communication and cellular metabolism, using the experimental techniques of biochemistry, molecular biology, cell biology and synthetic biology. Through the research and education 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 and metastasis, vesicle trafficking, extracellular microenvironment, cell-cell interaction, cellular metabolism, 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 accepted or published in 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. *If you are expected to complete the master course of our graduate school and are going to apply for this doctoral program after master course completion or if you are a government-financed international student (person receiving MEXT Scholarship grants), you are exempted from this fee but must include a statement to this effect when submitting the application.

【 Examination Process Flowchart 】

Applicants

Refer to the details of research studies performed by faculty members on pages 5 to 8 *

Request Application Guidebook

Qualification Review as needed (Refer to the application guidebook)

Appliecation (Refer to the application guidebook)

Entrance Examination

Successful Applicants Announcement

① August Examination	Mid-May	Mid-June	Mid-July	Late Aug.	Mid-Sept.
② January Examination	Mid-Oct.	Early Nov.	Early Dec.	Late Jan.	Late Feb.
③ Special Selection for International Applicants	Early May	Late May	Early June	Late June - Early July	Late July

* 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 by ensuring that medical care involving radiation is properly performed. In radiotherapy, medical physicists optimize treatment plans and conduct quality control and verification of the actual medical application working with physicians, clinical radiological technologists and radiotherapy quality control specialists. Medical physicists also confirm the accuracy of the position and the amount of radiation 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 to 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 with the clinical radiological technologists. They also engage in medical physics research related to diagnostic radiology.
1,427 medical physicists (as of December 1,2022) and 79 therapeutic medical physicists (as of April 1,2022) have been certified in Japan by the Japanese Board for Medical Physicist Qualification. They are actively working in various fields including education, research, clinical settings and industry.

■ About the Program

This program 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. For example, the required number of years of experience in medical physics for those who have completed a master's degree is reduced from three to two years.
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. 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/).

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

about the curriculum

website of the JBMP

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 Certified Medical Physicist

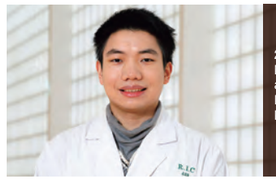
To Those Aspiring to Become Medical Physicists

I entered the doctoral program at the Graduate School of Medicine, Hokkaido University in 2016, the year before the Graduate School of Biomedical Science and Engineering was established. The curriculum of the Medical Physics Educational Program covers the content of the medical physicist certification exam, and I received ample training in clinical practice, especially quality control and assurance. I was also able to do medical physicist work related to real-time tumor-tracking and proton beam therapy, which are unique features of Hokkaido University. Such experience was not only helpful to prepare for the medical physicist certification exam, but also provided many insights for my own research.
I completed the doctoral program in 2020 and am currently working in research and development of diagnostic medical devices at a company. Although my specialty within the field of medical physics has changed from radiation therapy to diagnostic imaging, the knowledge and experience I have gained through the Medical Physics Educational Program is used in many aspects of my daily work.

Philips Japan, Inc.
MR Clinical Scientist

Division of Medicine (Doctoral Program),
Hokkaido University Graduate School of Medicine
(graduated in March 2020)
KWON Jihun

Message from an International Student



2nd-year Master Student
Molecular Biomedical Science and Engineering Course,
Department of Integrated Molecular Imaging,
LIN Longxin
【China】

Choose world-class education and research environment, choose to be a great researcher

I am enrolled in the master's program of the Graduate School of Biomedical Science and Engineering at Hokkaido University, which its beautiful campus and world-class education and research environment.
With the progress of medicine, more precise diagnosis and therapy are necessary. I am conducting research in nuclear medicine, which offers solutions to more precise medicine. This rapidly growing field combines medical imaging, molecular biology, and radiation physics to diagnose and treat diseases. Our research team has designed various kinds of nuclear pharmaceuticals that are applied to diagnosis and therapy. I will continue this pharmaceutical research to contribute to the development of nuclear medicine.
I chose this Graduate School because the curriculum not only provides a comprehensive understanding of nuclear medicine, but also multidisciplinary skills and knowledge covering medicine, physical science, and engineering.
There are also many opportunities to communicate with scientists from around the world. I can truly recommend our Graduate School as it provides a supportive and dynamic environment in which to pursue one's education and research goals.

Number of International Students

(Data as of March 1, 2023)

■ Distribution by Country/Region

Area	Country/Region	Number
Asia 4 students(67%)	China	3
	Mongolia	1
Africa 2 student (33%)	Nigeria	1
	Ghana	1
TOTAL		6

■ International Student Numbers by Graduate Program

( ):number of female students included

Master's Program	Doctoral Program
2(0)	4(0)

■ Methods of Financial Support

Japanese government	1
Self-Supported	5
TOTAL	6

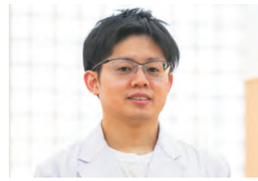
Messages from the Former / Graduated Students

Sony Semiconductor Solutions Corporation

March 2020 graduate of Master's degree program
FUKUDA Shunsuke

Understanding the Joy of Manufacturing

I was interested in developing medical devices when I majored in radiation during undergraduate school, so I went on to the Graduate School of Biomedical Science and Engineering. My research theme during graduate school was the development of PET equipment that can be attached to radiotherapy equipment. In PET equipment, signal processing is performed by HW to process a large amount of radiation event information instantly, and my research activities focused on the design of signal processing circuits. I was able to work on this theme for two years and I believe this was a very valuable experience.
While I encountered numerous issues in design and development, that experience helped me expand the scope of my job search, which led to my current occupation as a circuit design engineer.
In my graduate school life, I learned the joy of manufacturing and was able to expand my job search options. I think this kind of experience is one of the appeals of the Graduate School of Biomedical Science and Technology.



postdoctoral researcher,
Global Center for Biomedical Science and Engineering,
Hokkaido University

March 2022 graduate of Doctoral Program
NISHIOKA Soichiro

Attractiveness of Fusion of Different Fields

I received my master's and doctoral degrees from the Graduate School of Biomedical Science and Engineering. Here I studied the mechanisms of cancer cell resistance to radiation at the molecular level. It was fulfilling to make discoveries that lead to further discoveries. I wish to remain at the university and contribute to advances in medicine through cell biological research.
The strength of this graduate school is that experts in the diverse fields from both biological and physical sciences collaborate to solve medical problems, and opinions can also be exchanged with those engaged in both basic and applied clinical research. Professors at the Graduate School of Biomedical Science and Engineering are enthusiastic about both education and research, and support students to cultivate expertise in their field, learn to conduct research, and obtain communication skills while working hard in a favorable environment. If you are interested, please feel free to visit the laboratory and see the research content, feel the atmosphere, and get to know the personalities of the members.

Main entrance of Graduate School of Biomedical Science and Engineering

Main lecture room
(Faculty of Medicine, Northeast Research Bldg., 5F)

◇The names for graduate schools located in the same building as the faculty are omitted
◇( ) indicates other facility
※When both graduate school and undergraduate facilities are in the same building, the map only shows undergraduate.

N

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