Academic Year 2024

GRADUATE SCHOOL OF MEDICAL SCIENCES

SYLLABUS

DOCTOR'S COURSE

FUJITA HEALTH UNIVERSITY
GRADUATE SCHOOL OF MEDICAL SCIENCES

Table of Contents

Concerning the curriculum of the Graduate School of Medical Sciences (Doctoral Program), Fujita Health University ---------- i
The Three Policies of the Graduate School of Medical Sciences ---------- iii
The number of total required credits ---------- vi
Curriculum table ---------- vii
Subjects and instructors ---------- viii

Common subjects

Subject Page
Introduction to Medical Sciences ---------- 1
Research Methodology of Medical Sciences ---------- 3

Clinical Laboratory Sciences

Clinical Laboratory Sciences

Subject Page
Clinical Laboratory Sciences, Advanced ---------- 5
Clinical Laboratory Sciences Exercise ----------7
Graduate Thesis of Clinical Laboratory Sciences ----------9

Radiological Sciences

Radiological Sciences

Subject Page
Radiological Sciences, Advanced ---------- 12
Radiological Sciences Exercise ---------- 14
Graduate Thesis of Radiological Sciences ---------- 16

Biomedical Engineering

Biomedical Engineering

Subject Page

Biomedical Engineering, Advanced ---------- 18

Biomedical Engineering Exercise ---------- 20

Graduate Thesis of Biomedical Engineering ---------- 21

Concerning the curriculum of the Graduate School of Medical Sciences (Doctoral Program), Fujita Health University

Aiming to acquire an extensive knowledge in medical science and draft an original doctoral dissertation

Kuniaki Saito, Dean of the Graduate School of Medical Sciences, Fujita Health University

The Major in Medical Sciences, Graduate School of Medical Sciences (Doctoral Program), Fujita Health University, is based on the founding spirit of "Our Creativity For The People." We aim to cultivate versatile human resources who can respond widely to the sophistication, complexity, and diversification of modern medical care in addition to displaying the specialized knowledge and skills gained through the master's program. We established the two department, Clinical Laboratory Sciences (medical technology sciences), Medical Radiation Sciences (radiation sciences). To become well-rounded educators, researchers, and leaders, students are exposed to the advanced academic foundation of health science common to medical science. In addition to the above department, Medical and Health Care Professional Collaboration and Healthcare Regulatory Science (Medical and Health Care Sciences) were established in the academic year of 2020. In April 2024, we abolished the field of medical and health care sciences and established the department of nursing integrated sciences (nursing medical sciences).

At Fujita Health University, a unique curriculum is tailored in accordance with the aforementioned slogan, helping students gain a working knowledge in medical science. In the first year of each field, students learn rudimentary concepts of medical science that are common to each field through the Common (collaboration) Subjects of introduction to medical science, research methodology of medical sciences, and introduction to medical and health care professional collaboration. In seminars, students deepen their knowledge and skills of the medical profession and are exposed to the present-day theory and knowledge in each field. Exercises help students acquire basic ideas on exploring the problems to be solved and provide the right training for thinking to solve the problems. Through the Graduate Thesis conducted from the 1st to 3rd years and by exploring cutting-edge, up-to-date knowledge and examining issues in technological development, students are able to improve their creativity, theory-building skills, and active problem-solving abilities. As Graduate Thesis is built upon continuous investigation and accumulation of results, it is best to study this subject continuously for three years. During the first semester of the first year, a research plan will be decided, and the development of the research commences in the second semester. In the third year, a doctoral dissertation on the researched topics should be formulated, and as the lead authors, students ought to publish their research results in international journals to widely disseminate their research findings.

In the syllabus, the course periods, outline, goals, lesson plans, evaluation methods, teaching materials/textbooks/reference materials, preparatory learning, and points to note while pursuing a course are all listed for each subject to allow the graduate students decide on their learning activities as independently as possible. It is also vital for faculty members and graduate students to come up with effective ways to achieve learning outcomes, clearly understand their responsibilities and obligations, and work together. It is my hope that the graduate students maintain a broad view of the entire class in accordance with the syllabus and that they enthusiastically engage in learning

activities with a strong sense of purpose.

It is the desire of all faculty and staff members that the three years of research will be a fulfilling experience, providing a strong basis for future career development for the graduate students at the Graduate School of Health Sciences, Fujita Health University.

Three Policies of the Graduate School of Medical Sciences

1. Admission policy (Admission policy)

The Doctoral Course in the Graduate School of Medical Sciences accepts candidates who have graduated from a university, completed a postgraduate master's or pre-doctoral course, or have equivalent or better abilities.

(1) Individuals who aspire to conduct research in various fields based on medical science to seek scientific evidence and solve various medical problems.
(2) Individuals who are enthusiastic about searching for the truth through the development of new knowledge and technologies related to their research themes.
(3) Individuals who are motivated to adopt advanced technologies and disseminate innovative research results worldwide.
(4) Individuals aspiring to become educators, researchers, and leaders are highly motivated to return their research results to society and contribute to the development of medical science.

To select candidates who agree with the educational philosophy and objectives of the school, the following admission process is conducted:

- The abilities and qualities related to (1)-(4) above will be evaluated based on the submitted documents and specialized subjects related to the applicant's chosen field of study and an interview.
- Basic language skills related to (3) will be evaluated through an English examination.

- The University's priority for admission is not affected by sex, race, religion, sexual orientation, socio-economic status, or physical ability.
- Antismoking initiative:

As a university that trains medical professionals to protect people's health, Fujita Health University requires applicants to be able to promise that they will not smoke.

2. Curriculum and implementation policy (curriculum policy)

In the Doctoral Course of the Graduate School of Medical Sciences, for students to acquire the three abilities listed in the Diploma Policy, the three disciplines of "Clinical Laboratory Sciences", "Radiological Sciences, and "Biomedical Engineering" are established, and coursework and research work are systematically arranged according to the curricular organizing policies listed below. Coursework consists of special and common subjects, and classes are conducted through an appropriate combination of lectures and exercises, leading to the effective acquisition of advanced specialized knowledge, techniques, and practical skills. Research consists of activities that lead to the acquisition of skills necessary for setting and solving problems, disseminating research results domestically and internationally, and utilizing advanced technology through special research.
Educational content, methods, and evaluations are defined as follows:

(1) Educational contents
(1-1) In the field of "Clinical Laboratory Sciences," the subjects are arranged as follows.

・ To foster excellent laboratory scientists who can respond to changes in healthcare through research and to produce academic educators, researchers, and leaders, ‘Clinical Laboratory Sciences Seminar,’ ‘Clinical Laboratory Sciences Exercise,’ and ‘Graduate Thesis of Clinical Laboratory Sciences’ will be arranged.

(1-2) In the field of “Radiological Sciences,” the subjects are arranged as follows.

- To produce educators, researchers, and leaders who, through their research, can respond appropriately to rapidly developing technologies and contribute to the development of clinical applications of radiation medicine that are more accurate and safer, ‘Radiological Sciences Seminar’, ‘Radiological Sciences Exercise’, and ‘Graduate Thesis of Radiological Sciences' will be arranged.

(1-3) In the field of “Biomedical Engineering”, the subjects are arranged as follows.

- To foster outstanding medical researchers and engineers who can promote further technological innovation through research, and to produce academic educators, researchers and leaders, ‘Biomedical Engineering Seminar’, ‘Biomedical Engineering Exercise' and ‘Graduate Thesis of Biomedical Engineering' will be arranged.

(2) Educational method

・Individual guidance is provided to allow students to acquire advanced knowledge as academic educators, researchers, and leaders, and to promote a series of research activities, such as setting research questions, planning research, carrying out experiments, surveys and analyses, and writing papers.

- Active learning is promoted by incorporating student presentations and group discussions.
- To promote internationalization, lectures and discussions will be conducted in English.
- To acquire presentation and communication skills in carrying out research and presenting papers, supervision will be provided. Detailed research guidance and guidance on writing and presenting papers are provided.

(3) Evaluation and feedback

- Based on the achievement of the objectives stated in the syllabus of each subject, feedback is provided on the presentations and deliverables made by the students, including explanations and suggestions for improvement by the professors.
- Based on the research guidance plan and progress report submitted annually, the supervisor provides feedback to the student in charge.
- Doctoral thesis examination and doctoral thesis presentation assess whether the candidate has acquired the ability to carry out research and develop ethics, logic, thesis writing, and presentation skills.
- To ensure that educational programs function effectively, the results of degree programs based on the three policies of diploma, curriculum, and admission were monitored and evaluated to help improve education.

3. Criteria for graduation (Diploma Policy)

In the case of the Doctoral Program in Medical Sciences, the criteria for degree recognition are that the student has been enrolled for the prescribed number of years, has earned the prescribed

credits set in accordance with the educational philosophy and objectives, and has acquired the following abilities in the thesis examination and final examination.

(1) Ability to work globally
- With an eye to changes in healthcare and society, they can disseminate innovative research results worldwide and play an active role both domestically and internationally.

(2) Ability to work together
- They can solve research problems while making full use of advanced technology based on industry-government-academia-industry and cross-disciplinary cooperation and are able to disseminate the research results obtained widely.

(3) The willingness to create the future medical care
- The ability to develop future healthcare through medical innovation and train the next generation of diverse medical professionals.

The number of total required credits

1） Clinical Laboratory Sciences, Radiological Sciences, Biomedical Engineering

Course	Number of credits		Notes
	Required	Elective	
Common subjects	4 credits		
Clinical Laboratory Sciences	6 credits	4 credits	10 credits for each fields
Radiological Sciences	6 credits	4 credits	
Biomedical Engineering	6 credits	4 credits	
Total	14 credits or more		

Curriculum table

Field	Subject	Credit (Hours)		1st year		2nd year		3rd year	
		Required	Elective	Autumn semester	Spring semester	Autumn semester	Spring semester	Autumn semester	Spring semester
Common Subjects	Introduction to Medical Sciences	2 (30)		2					
	Research Methodology of Medical Sciences	2 (30)			2				
Clinical Laboratory Sciences	Clinical Laboratory Sciences, Advanced		2 (30)	2					
	Clinical Laboratory Sciences Exercise		2 (30)		2				
	Graduate Thesis of Clinical Laboratory Sciences	6 (180)			1	1	2	1	1
Radiological Sciences	Radiological Sciences, Advanced		2 (30)	2					
	Radiological Sciences Exercise		2 (30)		2				
	Graduate Thesis of Radiological Sciences	6 (180)			1	1	2	1	1
Biomedical Engineering	Biomedical Engineering, Advanced		2 (30)	2					
	Biomedical Engineering Exercise		2 (30)		2				
	Graduate Thesis of Biomedical Engineering	6 (180)			1	1	2	1	1

Subjects and instructors

Field	Course Title	Credits	Hours	Instructor
Common Subjects	Introduction to Medical Sciences	2	30	SAITO Kuniaki, TAKEMATSU Hiromu NARUSE Hiroyuki, SUZUKI Koji IHIRA Masaru, KOBAYASHI Shigeki ASADA Yasuki
	Research Methodology of Medical Sciences	2	30	SAITO Kuniaki, TAKEMATSU Hiromu NARUSE Hiroyuki, SUZUKI Koji IHIRA Masaru, MOURI Akihiro KOBAYASHI Shigeki, ASADA Yasuki TAKATSU Yasuo
Clinical Laboratory Sciences	Clinical Laboratory Sciences, Advanced	2	30	SAITO Kuniaki, ICHINO Naohiro TAKEMATSU Hiromu NARUSE Hiroyuki, SUZUKI Koji MOURI Akihiro, NAGAO Shizuko YAMAMOTO Yasuko
	Clinical Laboratory Sciences Exercise	2	30	ICHINO Naohiro, TAKEMATSU Hiromu NARUSE Hiroyuki, SUZUKI Koji MOURI Akihiro, YAMAMOTO Yasuko
	Graduate Thesis of Clinical Laboratory Sciences	6	180	ICHINO Naohiro, TAKEMATSU Hiromu NARUSE Hiroyuki, SUZUKI Koji MOURI Akihiro, YAMAMOTO Yasuko
Radiological Sciences	Radiological Sciences, Advanced	2	30	KOBAYASHI Shigeki, ASADA Yasuki TAKATSU Yasuo
	Radiological Sciences Exercise	2	30	KOBAYASHI Shigeki, ASADA Yasuki TAKATSU Yasuo
	Graduate Thesis of Radiological Sciences	6	180	KOBAYASHI Shigeki, ASADA Yasuki TAKATSU Yasuo
Biomedical Engineering	Biomedical Engineering, Advanced	2	30	IHIRA Masaru, ITO Hiroyasu MIURA Yasuo, FUJIGAKI Hidetsugu UMEZAWA Eizou, HATTORI Hidekazu MIZUTANI Kenmei, OHASHI Atsushi HORI Hideo
	Biomedical Engineering Exercise	2	30	IHIRA Masaru, ITO Hiroyasu MIURA Yasuo, FUJIGAKI Hidetsugu UMEZAWA Eizou
	Graduate Thesis of Biomedical Engineering	6	180	IHIRA Masaru, ITO Hiroyasu MIURA Yasuo, FUJIGAKI Hidetsugu UMEZAWA Eizou

1. Common Subjects

Introduction to Medical Sciences

専攻分野 Major Field	common(collaboration)	学年 Grade	1st year	期　間 Semester	1st semester
授業形態 Style	lecture	単位 Credits	2	時間数 Hours	30
授業方法 Class Methods	remote class	使用言語 Language	English		
担当教員名 Instructor	SAITO Kuniaki, TAKEMATSU Hiromu, NARUSE Hiroyuki, SUZUKI Koji, IHIRA Masaru, KOBAYASHI Shigeki, ASADA Yasuki				
科目概要 Course Aims	These lectures will be given on research topics in medical sciences (bioinformatics, medic quantum science, rehabilitation therapy science, nursing integrated science) by omnibus format. In these lectures, students will acquire a wide range of knowledge and ideas common to medical sciences, conduct Q & A sessions, and build a research base for specialized subjects. These lectures will be instructed in English only, including questions, answers, and opinions. （Omnibus style / Total 15 chapters）				
到達目標 Objectives	The goals of this course are to be able to - respond to a wide variety of modern medical needs. - become a true leader in team medicine. - acquire a wide range of knowledge and ideas common to medical science and build a research foundation for specialized subjects. and final goal of these lectures are to be able to discuss in English.				

回数 Chapters	授業計画 Course schedule (topic for each time)	担当教員 Instructor
1	Introduction　To be active on the global stage	SAITO Kuniaki
2	To achieve preemptive medical care	SAITO Kuniaki
3	Evolutional medicine; human-specific inflammatory condition	TAKEMATSU Hiromu
4	Regulations of immune cell: modification by cell surface glycans	TAKEMATSU Hiromu
5	Cell cycle: mitosis and endomitosis	TAKEMATSU Hiromu
6	Risk stratification using biomarkers in cardiovascular disease	NARUSE Hiroyuki
7	Acute kidney injury in cardiovascular disease	NARUSE Hiroyuki
8	Detection of nucleic acid for POCT using isothermal amplification methods	IHIRA Masaru
9	Potential New Biomarkers Associated with Prognosis of percutaneous coronary intervention	IHIRA Masaru o
10	Biomarkers in epidemiology	SUZUKI Koji
11	Molecular epidemiological study regarding life-style related diseases	SUZUKI Koji
12	Latest research of clinical use for photon-counting technology	KOBAYASHI Shigeki
13	The study's methodology using technique of artificial inteligence in medical imaging, RSNA	KOBAYASHI Shigeki
14	The diagnostic reference levels	ASADA Yasuki
15	Transition of Medical Exposure	ASADA Yasuki

評価法･基準 Grading Policies	Grading will be described based on students' attitude (30%), Discussion with faculty members etc. (70%) by course manager SAITO Kuniaki. In order to measure the level of comprehension of the goals, assign tasks such as reports, material creation, etc., oral examinations for each.

教科書 Textbook	Distribute each time.	教材・参考書 Reference Book	If necessary, introduce appropriate.
オフィス アワー Office Hour	SAITO： by email TAKEMATSU: by email NARUSE： by email SUZUKI： by email IHIRA： by email KOBAYASHI： by email ASADA：by email	連絡先 Contact	
準備学習 Preparation of study	These lectures will be instructed in English only, including questions, answers and opinions. Preparatory study of the specified theme for about 30 minutes. After the lecture, review the lecture with handout for about 1 hour and summarize them in a notebook.	履修上の注意点 Notice for Students	None

Research Methodology of Medical Sciences

専攻分野 Major Field	Common (collaboration)	学年 Grade	1st year	期 間 Semester	2nd semester
授業形態 Style	Lecture	単位 Credits	2	時間数 Hours	30
授業方法 Class Methods	remote class	使用言語 Language	Japanese		
担当教員名 Instructor	SAITO Kuniaki (Course Manager), TAKEMATSU Hiromu, NARUSE Hiroyuki, SUZUKI Koji, IHIRA Masaru, MOURI Akihiro, KOBAYASHI Shigeki, ASADA Yasuki, TAKATSU Yasuo				
科目概要 Course Aims	To provide instruction on the latest research in the fields of bioinformatics, medical quantum science, rehabilitation therapy science and nursing integrated science based on concrete examples. The course is designed to engage students in active discussion to learn about collaborative research among the aforementioned four fields of medical science and utilize it in their own fields (Omnibus format/total of 15 lectures).				
到達目標 Objectives	To obtain working knowledge and skills related to research in physiology/biochemistry, statistical epidemiology, pathology, diagnostic imaging, motor control measurement science, and rehabilitation education science in the three fields of medical science as well as acquire the ability to utilize the aforesaid knowledge for research				

回数 Chapters	授業計画 Course schedule (topic for each time)	担当教員 Instructor
1	Elegant dissertation writing and research ethics	SAITO Kuniaki
2	Genetical research methods, analyzing genotype and phenotype	TAKEMATSU Hiromu
3	Etiology analysis method in cardiovascular disease	NARUSE Hiroyuki
4	Molecular biological analysis (molecular techniques for detecting viruses)	IHIRA Masaru
5	MicroRNA expression analysis methods	IHIRA Masaru
6	Basic epidemiological research methods	SUZUKI Koji
7	Application of epidemiological analysis methods	SUZUKI Koji
8	Development of antipsychotics using animal models of schizophrenia and its methodology.	MOURI Akihiro
9	Development of antidepressants using animal models of depression and its methodology.	MOURI Akihiro
10	Etiology analysis method : image analysis	KOBAYASHI Shigeki
11	Medical Exposure	ASADA Yasuki
12	Dosimetry for Medical Exposure	ASADA Yasuki
13	Contrast-enhanced dynamic analysis of the live MRI	TAKATSU Yasuo
14	Contrast-enhanced dynamic analysis of the breast MRI	TAKATSU Yasuo
15	Image evaluation by diffusion weighted image	TAKATSU Yasuo

評価法・基準 Grading Policies	Grading will be done based on students' attitude (30%) and discussion with faculty members and other staff (70%) by the Course Manager SAITO Kuniaki.

教科書 Textbook	Distributed each time	教材･参考書 Reference Book	When necessary, introduced appropriately
オフィス アワー Office Hour	SAITO： by email TAKEMATSU： by email NARUSE： by email SUZUKI： by email IHIRA： by email MOURI： by email KOBAYASHI： by email ASADA：by email TAKATSU： by email	連絡先 Contact	
準備学習 Preparation of study	Preparatory study of the specified theme for about 30 minutes. The lecture should be reviewed using the handout for about 1 hour after its delivery, and a summary should be written in a notebook.	履修上の注意点 Notice for Students	

2. Clinical Laboratory Sciences

Clinical Laboratory Sciences, Advanced

専攻分野 Major Field	Clinical Laboratory Sciences	学年 Grade	1st year	期 間 Semester	1st semester
授業形態 Style	lecture, seminar	単位 Credits	2	時間数 Hours	30
授業方法 Class Methods	remote class	使用言語 Language	Japanese		
担当教員名 Instructor	SAITO Kuniaki (subject manager), ICHINO Naohiro, TAKEMATSU Hiromu, NARUSE Hiroyuki, SUZUKI Koji, MOURI Akihiro, NAGAO Shizuko, YAMAMOTO Yasuko				
科目概要 Course Aims	Clinical laboratory science is a field aimed to understand human health through metabolomic status of individuals' body fluids. Therefore, development of the field relies on the development of methodology, enabling actual measurements and analyses. In this advanced seminar, topics are chosen in relation to the development of the clinical laboratory science. Topics includes novel methodologies in mass-spectrometry measurements, gene amplifications, etc. Students will read and discuss their own opinions based on cutting edge articles in the field. This course also aimed for students to plan their own experimental studies.				
到達目標 Objectives	1. Understand the current and future clinical laboratory science and able to plan own project. 2. Understand fundamental aspects on genetics and genetic modification methods as a basis to understand current biomedical research. Understand how glycan and lipid expression is regulated as a comparison with proteins, that are directly encoded by gene. 3. Learn for gene amplification technology, and understand for the technology to construction of measurement system for gene expression. 4. Learn epidemiological study design and field work in epidemiological studies and understand statistical analysis according to the type of the data and purpose. 5.The aim of this course is to help students acquire an understanding of the relationship between physiological cardiac electrical activity and respiratory dynamics in human development from newborn to adulthood. 6. Learn about how to establishment methods of biomarkers from topics related to biomarkers and acquire the ability to formulate research plans that can be developed independently.				

回数 Chapters	授業計画(各回のテーマ) Course Schedule (topic for each time)	担当教員 Instructor
1	Scientific direction for the future genomic Research	SAITO Kuniaki
2	Non-invasive assessment of liver fibrosis using ultrasonography	ICHINO Naohiro
3	Assessment of arteriosclerosis using carotid ultrasonography	ICHINO Naohiro
4	Cell surface expression of glycans and its function	TAKEMATSU Hiromu
5	Intracellular signaling	TAKEMATSU Hiromu
6	Current diagnosis in cardiovascular disease	NARUSE Hiroyuki
7	Current treatment in cardiovascular disease	NARUSE Hiroyuki
8	Community-based epidemiology	SUZUKI Koji
9	Statistical analysis according to data types and purpose	SUZUKI Koji
10	Development of the therapeutics for the neuro-psychiatric disease	MOURI Akihiro
11	Development of the diagnostics for the neuro-psychiatric disease	MOURI Akihiro
12	Topics about biomarkers -blood and urine-	NAGAO Shizuko
13	Topics about biomarkers -genome-	NAGAO Shizuko
14	Metabolomics analysis technology	YAMAMOTO Yasuko
15	Metabolomic analysis of various diseases	YAMAMOTO Yasuko

評価法・基準 Grading Policies	Your overall grade in the class will be decided based on the presentation and short reports. Feedback of your presentation will be provided by each instructor.		
教科書 Textbook	Regimen will be provided in the class.	教材・参考書 Reference Book	Not specified
オフィスアワー Office Hour	Contact us by email if you have any questions.	連絡先 Contact	
準備学習 Preparation of study	Students prepare about each theme for 30 minutes before the class and review about the theme for 60 minutes.	履修上の注意点 Notice for Students	Doctoral students are advised to summarize each topics after the class.

Clinical Laboratory Sciences Exercise (Development of Medical Technology)

専攻分野 Major Field	Clinical Laboratory Sciences	学年 Grade	1st year	期 間 Semester	2nd semester
授業形態 Style	exercise, seminar	単位 Credits	2	時間数 Hours	30
授業方法 Class Methods	face-to-face class	使用言語 Language	Japanese		
担当教員名 Instructor	ICHINO Naohiro, TAKEMATSU Hiromu, NARUSE Hiroyuki, SUZUKI Koji, MOURI Akihiro, YAMAMOTO Yasuko				
科目概要 Course Aims	To master various technical theories, such as chemical, physical, biological, immunological and informatic methods, which are essential in the medical science field. For the development of new laboratory science and technology, it is necessary to comprehensively and practically learn the fundamentals of analytical technology supported by related academic systems such as analytical chemistry. You will learn these technical features and the knowledge necessary for data analysis and evaluation mainly by reading Japanese and foreign documents and practicing data analysis. Through the explanations and discussions, we will build a base of knowledge and technology that can contribute to the development of laboratory science, such as methods for improving laboratory science and technology, development of advanced analytical instruments, and searching for new biomarkers.				
到達目標 Objectives	The goals of this course are to - be able to explain the knowledge and skills of each research by development the ability to the research. - be able to explain the references searched of each research themes. - be able to develop the ability to make presentations with your own thoughts.				

回数 Chapters	授業計画(各回のテーマ) Course Schedule (topic for each time)	担当教員 Instructor
1-15	(ICHINO Naohiro) To acquire the latest techniques and methods in ultrasonic testing, it is necessary to search for and read scientific literature that serves as the scientific basis. Through discussions and question-and-answer sessions, students will learn the theories and methodologies, and build a knowledge foundation. Furthermore, through practical skills and data analysis exercises, students will reconfirm the basic techniques of ultrasonography and build a technical foundation for new examination techniques. (TAKEMATSU Hiromu) Course is organized to not only to acquire the latest development in the field of immunology and molecular cell biology, but also to logically adapt those development into prospective to achieve real understanding of the field. Therefore, importance of discussions for constructing real knowledge base will be emphasized. (NARUSE Hiroyuki) Learn about the usefulness of biomarkers through literature searches and analysis of clinical data, and acquire skills related to presentation and scientific considerations. (SUZUKI Koji) Learn how to read and discuss articles and how to apply epidemiological methods to their research theme through reading and discussing relevant journal articles. (MOURI Akihiro) To develop new diagnostics and therapeutics for neuropsychiatric disorders by conducting translational research to apply the results obtained in basic research to clinical applications. In carrying out translational research, students learn methodology and logical development by searching the literature for the scientific basis of the research, reading abstracts and answering questions.	

	(YAMAMOTO Yasuko) To acquire knowledge and skills in the analytical methods that are necessary for the performance of biochemical and molecular biological analyses of biological samples.		
評価法・基準 Grading Policies	Evaluation: Grade is evaluated by the participation during the class. Feedbacks: Assignments are rated when returned.		
教科書 Textbook	Lecture materials are provided in the class when needed.	教材・参考書 Reference Book	Not specified.
オフィスアワー Office Hour	Contact us by email if you have any questions.	連絡先 Contact	
準備学習 Preparation of study	30 min preparation on each topics are needed. For exercises using R software, please refer to the materials and download R to your laptop in advance.	履修上の注意点 Notice for Students	Doctoral students are advised to summarize each topics after the class.

Graduate Thesis of Clinical Laboratory Sciences

専攻分野 Major Field	Clinical Laboratory Sciences	学年 Grade	1st ・ 2nd ・ 3rd year	期 間 Semester	full year
授業形態 Style	exercise, research	単位 Credits	6	時間数 Hours	180
授業方法 Class Methods	face-to-face class	使用言語 Language	Japanese		
担当教員名 Instructor	ICHINO Naohiro, TAKEMATSU Hiromu, NARUSE Hiroyuki, SUZUKI Koji, MOURI Akihiro, YAMAMOTO Yasuko				
科目概要 Course Aims	Highly specialized knowledge can be acquired by conducting research activities on research themes. You will develop the ability to promote a series of research activities, such as setting research themes, drafting research plans, analyzing experiments, and writing dissertations. （ICHINO Naohiro） Current ultrasonography has made it possible to measure tissue stiffness. We will provide research for the early detection and diagnosis of diseases by applying this technology. Specifically, research guidance will be provided on the following topics. 1. A novel scoring system for non-invasive and differential diagnosis of NAFLD/NASH. 2. Development of biomarkers for pre-arteriosclerosis diagnosis to preemptive medicine. (TAKEMATSU Hiromu) How to conduct research activity in the laboratory will be the starting point for development of researchers. Therefore, candidate students will be trained to acquire research skills. Following are projected studies students would be involved, aiming to understand still elusive functions of cellular glycans and lipids 1. Glycan-mediated signal modification downstream of B cell antigen receptor to produce antibody 2. CRISPR gene-editing screening for genetic understanding of cellular factors required for giant cell formation through endomitosis 3. Glycan/Lipid functional analyses utilizing genetically modified model organisms/cells (NARUSE Hiroyuki) Comprehensively analyze clinical data of various cardiovascular diseases and clarify the pathophysiology of the diseases. 1. Identification of high-risk plaques in patients with coronary artery disease 2. Efficacy of the COVID-19 vaccine in patients with cardiovascular disease （SUZUKI Koji） Through molecular epidemiological study using high-performance liquid chromatography and molecular biology techniques, we will contribute to elucidating the mechanism of lifestyle related diseases and aim to establish disease prevention from a new perspective. 1. Molecular epidemiological study on prevention of lifestyle-related diseases 2. Large-scale cohort study of cancer risk factors				

<table>
<tr><td>科目概要
Course Aims</td><td colspan="3">（MOURI Akihiro）
Neuropsychiatric disorders such as Alzheimer's disease, Parkinson's disease, depression, schizophrenia, and autism are the targets of research and investigated using patients' blood and other clinical samples. We translate epidemiological and genetic findings in humans to mice and create mouse models of neuropsychiatric disorders to explore pathophysiology and pathogenesis using behavioral, pharmacological and neurochemical techniques. Based on the these studies, we try to develop new therapeutics, functional foods, and diagnostic biomarkers and conduct translational research to contribute healthy society and development of medicine.
1. Elucidating the pathophysiology of neuropsychiatric disorders using clinical samples and animal models
2. Developing pharmaceuticals and functional foods by basic research using animal models of neuropsychiatric diseases
3. Searching for biomarkers and developing diagnostic drugs for neuropsychiatric diseases

（YAMAMOTO Yasuko）
To realize preemptive medicine, we are developing biomarkers and diagnostic systems to predict the early onset of disease using samples from a database of healthy volunteers, including samples at risk for lifestyle-related diseases.
1. Analysis of biofunctional molecules using molecular biology techniques
2. Proteomic analysis in various diseases related to metabolic changes
3. Behavioral analysis using animal models - focus on tryptophan metabolism changes</td></tr>
<tr><td>到達目標
Objectives</td><td colspan="3">The goals of this exercise are to
- able to explain major methods and theories.
- able to evaluate major studies in terms of their methods and results.
- able to acquire the ability to write a dissertation in English.</td></tr>
<tr><td>回数
Chapters</td><td>授業計画（各回のテーマ）
Course Schedule (topic for each time)</td><td colspan="2">担当教員
Instructor</td></tr>
<tr><td>1-10
(1st year)</td><td>1. Understanding of the background of research
2. Planning of research
3. Preparation for examination application
1) Clinical Research Ethics Review Committee
2) Recombinant DNA Experiment Safety Committee
3) Animal Experiment Committee</td><td colspan="2" rowspan="5">ICHINO Naohiro
TAKEMATSU Hiromu
NARUSE Hiroyuki
SUZUKI Koji
MOURI Akihiro
YAMAMOTO Yasuko</td></tr>
<tr><td>11-15
(1st year)</td><td>After reviewing the research plan and approval of each committee, promote research activities.</td></tr>
<tr><td>16-60
(2nd year)</td><td>1. Analyze of experimental data.
2. Discuss the literature using the experiment data.
3. Create an academic paper and submit it to an academic journal.</td></tr>
<tr><td>61-90
(3rd year)</td><td>1. Continue research activities and develop your research.
2. Summarize the results and create a dissertation</td></tr>
<tr><td>長期履修
授業計画
Lecture plan for Long-term study</td><td>Students who wish to study for a long time will consult with their research advisor according to the duration of the course and make a class plan.</td></tr>
<tr><td>評価法・基準
Grading Policies</td><td colspan="3">Evaluation: Comprehensive evaluation based on presentations at academic conferences,
a cademic papers and doctoral dissertations.
Participation in a three-field joint research seminar is mandatory.
Feedbacks: Assignments are rated when returned.</td></tr>
<tr><td>教科書
Textbook</td><td>Lecture materials are provided in the class when needed.</td><td>教材・参考書
Reference Book</td><td>Not specified.</td></tr>
</table>

オフィス アワー Office Hour	Contact us by email if you have any questions.	連絡先 Contact	
準備学習 Preparation of study	Efforts to create a doctoral dissertation are important. Respect for personal information and ethics.	履修上の注意点 Notice for Students	Doctoral students are advised to summarize each topic after the class.

3. **Radiological Sciences**

Radiological Sciences, Advanced

専攻分野 Major Field	Radiological Science	学年 Grade	1st year	期 間 Semester	1st semester
授業形態 Style	Lecture, Seminar	単位 Credits	2	時間数 Hours	30
授業方法 Class Methods	remote class	使用言語 Language	Japanese		
担当教員名 Instructor	KOBAYASHI Shigeki, ASADA Yasuki, TAKATSU Yasuo				
科目概要 Course Aims	Current course deals radiation technology, theory and methods concerning image information processing applied in the field of radiology. We will discuss the latest basic technologies and clinical applications in a wide range of fields, including X-ray diagnostic equipment, CT, MRI, flat panel detectors, contrast agents, nuclear medicine diagnostic devices (SPECT, PET), PACS, etc.				
到達目標 Objectives	1. To understand the theory of medical image information processing. 2. To understand the latest imaging technology for each modality in the field of radiology. 3. To understand the clinical application of clinical image information processing for each modality.				

回数 Chapters	授業計画(各回のテーマ) Course Schedule (topic for each time)	担当教員 Instructor
1	Latest Imaging Technology: CT	KOBAYASHI Shigeki
2	Clinical Application of Clinical Image Information Processing: CT-1	KOBAYASHI Shigeki
3	Clinical Application of Clinical Image Information Processing: CT-2	KOBAYASHI Shigeki
4	Latest Imaging Technology: Nuclear Medicine	KOBAYASHI Shigeki
5	Clinical Application of Clinical Image Information Processing: Nuclear Medicine	KOBAYASHI Shigeki
6	State-of-the-art imaging technology: General Radiography	ASADA Yasuki
7	Clinical Application of Clinical Image Information Processing: General Radiography	ASADA Yasuki
8	State-of-the-art imaging technology: Mammography	ASADA Yasuki
9	Clinical Application of Clinical Image Information Processing: Mamography-1	ASADA Yasuki
10	Clinical Application of Clinical Image Information Processing: Mamography-2	ASADA Yasuki
11	Latest Imaging Technology: MRI	TAKATSU Yasuo
12	Clinical Application of Clinical Image Information Processing: MRI-1	TAKATSU Yasuo
13	Clinical Application of Clinical Image Information Processing: MRI-2	TAKATSU Yasuo
14	Clinical Application of Clinical Image Information Processing: MRI-3	TAKATSU Yasuo
15	Clinical Application of Clinical Image Information Processing: MRI-4	TAKATSU Yasuo

評価法・基準 Grading Policies	Presentations on issues (70%) and discussion content (30%) will be comprehensively evaluated.		
教科書 TextBook	Handout the necessary materials.	教材・参考書 Reference Book	

オフィス アワー Office Hour	Kobayashi: Perform by e-mail. ASADA: Perform by e-mail. TAKATSU: Perform by e-mail.	連絡先 Contact	
準備学習 Preparation of study	Be interested in everything and take a positive attitude.	履修上の注意点 Notice for Students	Bring a laptop with Office installed.

Radiological Sciences Exercise

専攻分野 Major Field	Radiological Science	学年 Grade	1st year	期 間 Semester	2nd semester
授業形態 Style	Practice, Seminar	単位 Credits	2	時間数 Hours	30
授業方法 Class Methods	face-to-face class	使用言語 Language	Japanese		
担当教員名 Instructor	KOBAYASHI Shigeki, ASADA Yasuki, TAKATSU Yasuo				
科目概要 Course Aims	We will read original papers and explanatory papers related to radiology, medical radiology, medical imaging informatics, etc., and discuss the contents of the paper and the description method. Students will be able to read English papers quickly, understand outlines quickly, find important matters, and understand them correctly. The purpose of this practice is to learn how to conduct research and experiments, and to build papers, and to make use of them in their own research. （Omnibus system / 15 classes in total）				
到達目標 Objectives	1. Can understand and briefly explain key English terminology in radiology, medical radiology, radiology management, and medical imaging informatics. 2. Can read abstracts of English papers in about 10 minutes and understand the outline. 3. In the text of an English paper, can read a page in less than 30 minutes and understand the outline. 4. Can understand and explain the diagrams and tables of English papers. 5. It is possible to verify and comment on the method, result, and closing of the English paper that I have subscribed to.				

回数 Chapters	授業計画（各回のテーマ） Course Schedule (topic for each time)	担当教員 Instructor
1-2	Reading the latest English paper on photon counting technology	KOBAYASHI Shigeki
3-5	Subscribe to the latest English paper on PET diagnosis	KOBAYASHI Shigeki
6	Reading the latest English paper on general radiography	ASADA Yasuki
7	Reading the latest English paper on mammography	ASADA Yasuki
8	Reading the latest English paper on angiographic techniques	ASADA Yasuki
9	Reading the latest English paper on CT	ASADA Yasuki
10	Reading the latest English paper on radiation health management	ASADA Yasuki
11	Reading the English papers on MRI (brain)	TAKATSU Yasuo
12	Reading the English papers on MRI (upper body)	TAKATSU Yasuo
13	Reading the English papers on MRI (pelvis)	TAKATSU Yasuo
14	Reading the English papers on MRI (extremities)	TAKATSU Yasuo
15	Reading an English paper on MRI (diffusion-weighted imaging method)	TAKATSU Yasuo

評価法・基準 Grading Policies	Issue report (70%) and discussion content (30%). The subject manager (Kobayashi) will evaluate it comprehensively.		
教科書 TextBook	Handout the necessary materials.	教材・参考書 Reference Book	Bring a laptop with Office installed.

オフィス アワー Office Hour	Kobayashi: Perform by e-mail. ASADA: Perform by e-mail. TAKATSU: Perform by e-mail.	連絡先 Contact	
準備学習 Preparation of study	Be interested in everything and take a positive attitude. Understand the outline of the English paper and briefly summarize the important matters.	履修上の注意点 Notice for Students	Bring a laptop with Office installed.

Graduate Thesis of Radiological Sciences

専攻分野 Major Field	Radiological Science	学年 Grade	1st ・ 2nd ・ 3rd year	期 間 Semester	full year
授業形態 Style	Practice	単位 Credits	6	時間数 Hours	180
授業方法 Class Methods	face-to-face class	使用言語 Language	Japanese		
担当教員名 Instructor	KOBAYASHI Shigeki, ASADA Yasuki, TAKATSU Yasuo				
科目概要 Course Aims	In this course, we conduct extensive research essential for the development of researchers and educators with knowledge of cutting-edge radiological science and technology. We analyze and understand the functions and structure of the human body using biometric information obtained from medical images, and practice and provide guidance on cutting-edge radiation medicine application research with a focus on research themes related to diagnostic imaging based on morphology and functional information. We provide paper guidance that can transmit information to society by presenting them in academic societies and academic journals in radiological sciences. （KOBAYASHI Shigeki） To understand the principles of photon-counting X-ray measurement and how to utilize energy information. We conduct a basic study on the imaging image and material identification function using a photon counting type X-ray detector and conduct research on the development of next-generation mammography for clinical use. For imaging modalities such as CT, MRI, and RI, we also conduct research on clinically useful software development using artificial intelligence (A.I.). （ASADA Yasuki） The aim is to study on radiation exposure of the diagnostic X-ray which the medical stuff included, to write a doctoral thesis. In that, to learn the choice of the study theme, the review of previous studies, planning of the study plan, experiment, and discussion in a series of process of writing paper. In addition, through the writing of the doctoral thesis, to learn the conscience of the scientist, the attitude toward study, an original idea, the way of the study. The theme is gathered to following three. 1. Study on evaluation of the patient doses for diagnostic X-ray examinations 2. Study on measurement of the patient doses for diagnostic X-ray examinations 3. Study on occupational radiation exposure of the medical stuff （TAKATSU Yasuo） 1. Pathological analysis using MR images 2. Quantitative evaluation of physical phenomena in MRI				
到達目標 Objectives	1. Can decide on research topics and research related literature. 2. Can decide on the framework of research promotion, gain research methods, and conduct research. 3. The interpretation and consideration of the research results can be logically established. 4. To write a doctoral dissertation				

回数 Chapters	授業計画（各回のテーマ） Course Schedule (topic for each time)	担当教員 Instructor
1-10 (1st year)	To examine and organize the previous research and understand the research trends in Japan and overseas. To set up research topics and develop research plans, and to prepare applications for examination of the Ethics Review Committee on Epidemiology and Clinical Research and the Animal Experiment Committee.	Each supervisor
11-15 (1st year)	Review the research plan and ethics review committee for epidemiology and clinical research, and the Animal Experiment Committee. To prepare for research and develop research activities.	

16-60 (2nd year)	Data collection, investigation, and experimentation in line with research plans, data analysis, discussion of research results, interpretation and evaluation of data, and consideration using relevant literature are carried out. To create an academic paper and submit it to a specialized academic journal.		
61-90 (3rd year)	Continue research activities, develop research content, and compile the results to produce a dissertation.		
長期履修 授業計画 Long-term study Class plan	Long-term students should consult with their research supervisor simply according to the duration of the course and make a lesson plan.		
評価法・基準 Grading Policies	Participation in three fields joint research seminars in the field is mandatory. Evaluations are comprehensively based on academic presentations, academic papers, and doctoral dissertations.		
教科書 TextBook		教材・参考書 Reference Book	
オフィス アワー Office Hour	Kobayashi: Perform by e-mail. ASADA: Perform by e-mail. TAKATSU: Perform by e-mail.	連絡先 Contact	
準備学習 Preparation of study	Actively explore themes with autonomy.	履修上の注意点 Notice for Students	

4. Biomedical Engineering

Biomedical Engineering, Advanced

専攻分野 Major Field	Biomedical Engineering	学年 Grade	1st year	期 間 Semester	1st semester
授業形態 Style	Lecture, Seminar	単位 Credits	2	時間数 Hours	30
授業方法 Class Methods	remote class	使用言語 Language	Japanese		
担当教員名 Instructor	IHIRA Masaru, ITO Hiroyasu, MIURA Yasuo, FUJIGAKI Hidetsugu, UMEZAWA Eizou, HATTORI Hidekazu, MIZUTANI Kenmei, OHASHI Atsushi, HORI Hideo				
科目概要 Course Aims	The aim of biomedical engineering is to develop medical devices and medical equipment such as clinical examination, diagnostic imaging, and life support devices by combination of medicine and engineering. In this lecture, students will learn new technical theories and acquire the ability to deeply consider and apply their own research themes through explanations and discussions using domestic and foreign literature.				
到達目標 Objectives	1. The deployment of new analytical technologies that integrate medicine and engineering, and acquire the ability to formulate their own research plans. 2. Understand the basic technologies that have contributed to the advancement of modern medicine and the image analysis technologies that are expected to be used in the future. 3. Understand the application of analytical technology, represented by CAD, and its relation to AI. 4. Understand the effects of medical devices on pathological conditions and biocompatibility. 5. Understand the overview of research design for regenerative medicine and understand the properties of polymeric materials.				

回数 Chapters	授業計画(各回のテーマ) Course Schedule (topic for each time)	担当教員 Instructor
1	Physiological activity, gene regulatory function, and biomarker applications of microRNAs	IHIRA Masaru
2	Methods for comprehensive measurement of genes and isothermal amplification techniques	IHIRA Masaru
3	Automatic PCR testing system	ITO Hiroyasu
4	Automatic blood sampling device	ITO Hiroyasu
5	Automatic microbial testing system	ITO Hiroyasu
6	Blood transfusion testing	MIURA Yasuo
7	Luminex testing with a particular emphasis on HLA testing	MIURA Yasuo
8	Principles of advanced diagnostic instruments such as mass spectrometers	FUJIGAKI Hidetsugu
9	Clinical applications of mass spectrometers and other advanced diagnostic instruments	FUJIGAKI Hidetsugu
10	New MR imaging methods	UMEZAWA Eizou
11	New analysis method for MR imaging	UMEZAWA Eizou
12	The Performance Evaluation and Utilization of CAD using Artificial Intelligence	HATTORI Hidekazu
13	Interrelationship between motor and neurological functional analysis of paralysis recovery after cerebral infarction and molecular mechanisms of neuroplasticity in the brain	MIZUTANI Kenmei
14	Relationship between biocompatibility and pathological improvement effect of medical devices that replace kidney, liver, pancreas, and immune functions	OHASHI Atushi
15	Safety, stability, and functionality of polymeric materials used in regenerative medicine	HORI Hideo
評価法・基準 Grading Policies		

教科書 TextBook		教材・参考書 Reference Book	
オフィス アワー Office Hour	IHIRA: After class or e-mail. ITO: E-mail me if you have any questions. MIURA: E-mail me if you have any questions. FUJIGAKI: After class or make an appointment by email UMEZAWA: as needed, 501-1, building 6. HATTORI: Bldg.No.3-2F-205, Thu, Friday 16:00-17:00 MIZUTANI: Bldg.No.6-4F-402, Mon-Fri 12:10-13:00 or by e-mail OHASHI: as needed, Build.7-6F- 603 HORI: E-mail me if you have any questions.	連絡先 Contact	
準備学習 Preparation of study		履修上の注意点 Notice for Students	

Biomedical Engineering Exercise

専攻分野 Major Field	Biomedical Engineering	学年 Grade	1st year	期 間 Semester	2nd semester
授業形態 Style	Practice, Seminar	単位 Credits	2	時間数 Hours	30
授業方法 Class Methods	face-to-face class	使用言語 Language	Japanese		
担当教員名 Instructor	IHIRA Masaru, ITO Hiroyasu, MIURA Yasuo, FUJIGAKI Hidetsugu, UMEZAWA Eizou				
科目概要 Course Aims	The objective is to acquire the ability to formulate own research plan to utilize new devices for future society through explanations and discussions using foreign literature.				
到達目標 Objectives	Understand the history of the development of biomedical engineering in the medical field and be able to explain it to others. 1. Read abstracts of English articles and explain the abstracts to others. 2. Explain the progress and content of the research to others based on the content of the presentation. 3. Review and discuss the content of the paper.				

回数 Chapters	授業計画(各回のテーマ) Course Schedule (topic for each time)	担当教員 Instructor
1-15	(IHIRA Masaru) Outline the properties of microRNA as a biomarker. (ITO Hiroyasu) Reading and discussing recent papers on the host immune response mechanisms and treatment methods in cancer and chronic infections. Practicing immunological analysis methods such as ELISA, ELISPOT, and flow cytometry. Learning how to create tumor-bearing mouse models and chronic infection mouse models. (MIURA Yasuo) We will exercise blood transfusion testing with a particular emphasis on Luminex testing, Flow cytometry method and PCR method. (FUJIGAKI Hidetsugu) Learning principles and clinical applications of instruments for omics analysis and how to search biomarkers in biological samples. (UMEZAWA Eizou) Students will read literature on new imaging and analysis methods of MRI and practice related mathematical methods through them.	

評価法・基準 Grading Policies	The course director will make a comprehensive judgment based on the content of discussions, presentations and reports.		
教科書 TextBook	Materials will be handed out.	教材・参考書 Reference Book	
オフィスアワー Office Hour	IHIRA: After class or e-mail. ITO: E-mail me if you have any questions. MIURA: E-mail me if you have any questions. FUJIGAKI: After class or make an appointment by email UMEZAWA: as needed, 501-1, building 6.	連絡先 Contact	
準備学習 Preparation of study		履修上の注意点 Notice for Students	

Graduate Thesis of Biomedical Engineering

専攻分野 Major Field	Biomedical Engineering	学年 Grade	1st ・ 2nd ・ 3rd year	期 間 Semester	full year
授業形態 Style	Practice	単位 Credits	6	時間数 Hours	180
授業方法 Class Methods	face-to-face class	使用言語 Language	Japanese		
担当教員名 Instructor	IHIRA Masaru, ITO Hiroyasu, MIURA Yasuo, FUJIGAKI Hidetsugu, UMEZAWA Eizou				
科目概要 Course Aims	Understand the metabolic function and structure of the human body and develop new medical devices by applying knowledge and technology in the field of engineering. Students will deepen their own research based on previous research and discussions with the mentor. The goal of this lecture is to achieve research results that will contribute to future society. （IHIRA Masaru） Through clinical virological research, we will provide guidance on research aimed at elucidating the pathogenesis of herpesvirus infections, especially Human herpesvirus 6（HHV-6）and Varicella zoster virus(VZV) 1. Pathophysiology of HHV-6 infection in the primary infection or immunosuppressed state of HHV-6. 2. Development of Rapid Diagnostic Methods for Novel Biomarkers Using Isothermal Amplification （ITO Hiroyasu） We develop new testing and treatment methods for cancer and chronic infectious diseases using immunological approaches. 1. Elucidation of immune checkpoint mechanisms in cancer and chronic infectious diseases and development of new testing and treatment methods. 2. Development of therapeutic vaccine therapy for chronic hepatitis B virus infection. （MIURA Yasuo） Elucidating intercellular crosstalk between tissue stem cells and hematopoietic cells. 1. Culture and functional analysis of tissue stem cells 2. Separation of biological nanoparticles （FUJIGAKI Hidetsugu） Research will be conducted to elucidate the pathophysiology of several diseases and to develop diagnostic devices and agents. 1. Search for biomarkers and development of diagnostic agents by metabolomic analysis. 2. Developing diagnostic and therapeutic agents for psychiatric diseases targeting amino acid metabolism. （UMEZAWA Eizou） Water molecules in living systems move around randomly in diffusion motion. Diffusion MRI uses statistical properties of the diffusion to obtain information about tissue microstructure and function. We study diffusion MRI using physics, mathematics, and mathematical data science. 1.Study on diffusion MRI. 2. Study on the mathematical and physical foundation of MRI, and new MRI imaging and analysis methods based on it.				
到達目標 Objectives	Students are able to research materials and literature related to the research topic. Students are able to determine the framework of research promotion, acquire research methods, and conduct research. Students are able to interpret and discuss research results in a logical manner. Students will prepare a doctoral dissertation.				

回数 Chapters	授業計画(各回のテーマ) Course Schedule (topic for each time)	担当教員 Instructor
1-10 (1st year)	Understand domestic and international research trends and set and plan research topics. Prepare applications for review by the Ethics Review Committee.	Each supervisor
11-15 (1st year)	The Ethics Review Committee will review the research plan and initiate research preparation and activities.	
16-60 (2nd year)	Collect data, interpret and evaluate data in accordance with the research plan. Prepare academic papers and submit them to specialized academic journals.	
61-90 (3rd year)	Continue research activities, develop research content, and summarize results to prepare a dissertation.	
長期履修 授業計画 Long-term study Class plan	Long-term students should consult with their research advisor and make a lesson plan according to the duration of the course.	

評価法・基準 Grading Policies	The content of conference presentations and academic papers (40%) and doctoral dissertation (60%) will be evaluated comprehensively. However, participation in joint research seminars is required.		
教科書 TextBook	Materials will be handed out.	教材・参考書 Reference Book	
オフィス アワー Office Hour	IHIRA: E-mai ITO: E-mail me if you have any questions. MIURA: E-mail me if you have any questions. FUJIGAKI: After class or make an appointment by email UMEZAWA: as needed, 501-1, building 6.	連絡先 Contact	
準備学習 Preparation of study	Actively explore themes with autonomy.	履修上の注意点 Notice for Students	