List of Major Subjects and Academic Advisors for 2024 Academic Year

*The major subjects and academic advisors may change as needed.

1）Field of Clinical Laboratory Sciences

Department of Clinical Laboratory Sciences

Course Title	Course Aims and Research Subject
Graduate Thesis of Clinical Laboratory Sciences SAITO Kuniaki ICHINO Naohiro TAKEMATSU Hiromu OHASHI Koji NARUSE Hiroyuki SUZUKI Koji MOURI Akihiro SUGIMOTO Keiko NAGAO Shizuko YAMAMOTO Naoki ISHIKAWA Hiroaki OSAKABE Keisuke YAMAMOTO Yasuko SHIOGAMA Kazuya HOSHI Masato MATSUURA Hideaki	***SAITO Kuniaki*** To help realize healthy life expectancy and preemptive medicine, we develop biomarkers and diagnostic systems for predicting early disease onset through industry-government-academia collaboration. 1. Amino acid metabolism and immune system 2. Analysis of various diseases based on metabolic changes 3. Personalized medicine - drug effect/side effect/prognosis prediction ***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*** We utilize genetics to understand important biological phenomena in the molecular biological level. Projects includes cellular responses of immune cells such as lymphocytes. Target molecules includes cellular glycans and lipids. 1. B cell antigen receptor signaling to control antibody production 2. Endomitosis, a specific cell cycle event to produce giant cells, controlled by glycolipid 3. Development of human-specific condition with xeno-auto-antigen mediated autoimmunity in mice ***OHASHI Koji*** Our research aims to elucidate the mechanisms of metabolic syndrome pathogenesis from an epigenetic perspective and to apply this to clinical testing. To elucidate the effects on the next generation of exposure at daily intake levels that do not directly affect the individual who ingests them at daily intake levels. ***NARUSE Hiroyuki*** We aim to elucidate the pathophysiology of various diseases using the clinical data and biomarkers, and apply it to clinical practice. 1. Study on the pathophysiology of cardiovascular disease using biomarkers. 2. Study on the pathophysiology of acute kidney injury using biomarkers. ***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 for evaluation of cancer risk

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Department of Genetic Counseling

Course Title	Course Aims and Research Subject
Graduate Thesis of Genetics OHYE Tamae	Create a master's thesis by researching specific themes related to genetic counseling, and reviewing the literature or gaining deep insight into the problems associated with the cases in which you were present. Through master's research, cultivate the qualifications involved in a certified genetic counselor with thinking and insight. ***OHYE Tamae*** 1. Study on support for patients with hereditary diseases and their families 2. Study on medical care and social support systems related to hereditary diseases 3. Study on coping with secondary findings found by accident by comprehensive inspection method

Department of Assisted reproductive medicine

Course Title	Course Aims and Research Subject
Graduate Thesis of Assisted Reproductive Medicine NISHIO Eiji	Our training course instructs assisted reproductive technology with murine gamete, fertilized egg and embryo using required culture media in incubating instruments. As the next step, clinical training will be performed using human gamete, fertilized egg and embryo, at clinical practice facilities of in-vitro fertilization and embryo transfer registered by the Japan Society of Obstetrics and Gynecology (Training mainly in Fujita Health University Hospital and/or other collaborating fertility clinics). Further, attendees will get higher ethical standards and dignity for assisted reproductive technology in experiencing the duties of clinical embryologist, with intense interest in this field. ***NISHIO Eiji*** 1. Research on the improvement of assisted reproductive technology through a basic approach. 2. Acquisition of essential knowledge and skills for assisted reproductive technology. 3. Obtain eligibility requirements for clinical embryologist qualifying examination. 4. Present case reports in a treatise format.

2）Field of Radiological Sciences

Department of Radiological Sciences

Course Title	Course Aims and Research Subject
Graduate Thesis of Radiological Sciences KOBAYASHI Shigeki MINAMI Kazuyuki TAKATSU Yasuo SHIRAKAWA Seiji SHIIBA Takuro MUTO Koichi KOBAYASHI Masanao TATEYAMA Tomoko	***KOBAYASHI Shigeki*** To promote research that contributes to the creation of next-generation medical care forms. 1. Study on the development of next-generation mammography using energy-resolved photon-counting X-ray detector 2. Study on improvement of medical efficiency using artificial intelligence for next-generation hospital forms. ***MINAMI Kazuyuki*** In this laboratory, we will conduct research on measurement and simulation of exposure dose in the field of nuclear medicine. 1. Study on radiation exposure evaluation method in nuclear medicine 2. Study on radiation protection measures in the field of nuclear medicine 3. Study on radiation exposure simulation ***TAKATSU Yasuo*** To study the involvement of biological systems using magnetic resonance imaging. Considering imaging techniques and their clinical applications, the aim is to provide information from the analysis and evaluation of images. 1. Analysis of clinical images using Magnetic Resonance Imaging. 2. Investigation of imaging methods and clinical evaluation in Magnetic Resonance Imaging ***SHIRAKAWA Seiji*** Through Monte Carlo simulation, this course will understand the physical processes related to nuclear medicine images, and will study image reconstruction and various compensation methods. 1. Monte Carlo simulation-based SPECT reconstruction 2. Study on image processing using deep learning ***SHIIBA Takuro*** To develop the ability to respond flexibly to a wide range of issues, understand the characteristics of molecular imaging, such as MRI and nuclear medicine, the acquisition of image processing, machine learning and Monte Carlo simulation techniques. 1. Analysis of medical imaging for neurodegenerative diseases 2. Study on evaluation of SPECT quantitative techniques. 3. Study on dose evaluation using Monte Carlo simulation for nuclear medicine therapy ***MUTO Koichi*** The research will focus on the application of medical informatics to radiology, from the development of information systems for radiology departments to the standardization of information related to the field of radiology, such as DICOM. Furthermore, the management and processing of the radiological big data will be studied. 1. Standardization of medical information and its application 2. Utilization of open source software in medical information system development 3. Data management and processing required for medical big data

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Graduate Thesis of Radiological Sciences KOBAYASHI Shigeki MINAMI Kazuyuki TAKATSU Yasuo SHIRAKAWA Seiji SHIIBA Takuro MUTO Koichi KOBAYASHI Masanao TATEYAMA Tomoko	***KOBAYASHI Masanao*** 1. Study on improvement of dosimetry and evaluation method in X-ray diagnosis 2. Study on development of dose evaluation method using Monte Carlo simulation 3. Research on international trends and evaluation of medical radiation systems 4. Study on development of digital teaching materials using virtual reality ***TATEYAMA Tomoko*** While CAD provides valuable information for diagnosis and clinical treatment, it is daily collecting medical images, biopsy information, and many other types of data of various types and properties, too. The effective establishment, storage, processing, and representation of the data will have a significant contribution to the enhancement of AI and CAD applications and their accuracy in the future.. 1. Data visualization and analysis in clinical scenes, and database publication (Fundamental research) 2. Medical Data fusion and Analysis of multimodality based on Artificial Intelligence (Fundamental research) 3. Assessment and Stage Estimation of Disease using 3D Morphological Changes of Organs based on AI (CAD) 4. Gesture Analysis and Database Publication for Support Clinical Operations (Support for diagnostic, surgical and therapeutic)

Department of Medical Physics

Course Title	Course Aims and Research Subject
Graduate Thesis of Medical Physics ASADA Yasuki HAYASHI Naoki MATSUBARA Hiroaki KUNITOMO Hiroshi YASUI Keisuke	Medical physics is application of physics to medicine and healthcare; using physics for patient imaging, management and treatment. In this course, students understand the significance of learning medical physics (especially, health physics and therapeutic radiological physics), and carry out individual theme study regarding development of the new technique or knowledge. Finally, students write thesis for master degree including the outcome in master course term. ***ASADA Yasuki*** 1. Analysis of patient exposure by general radiography and mammography 2. Study on measurement of X-ray quality and output 3. Development of software for estimation of patient exposure in diagnostic X-ray domain ***HAYASHI Naoki*** 1. Study on standard dosimetry for therapeutic radiation. 2. Study on safer radiotherapy procedure and its assessment with FMEA. 3. Study on improvement of accuracy and precision in radiotherapy. 4. Study on development of surface image guidance system ***MATSUBARA Hiroaki*** 1. Study of malfunctions in cardiac implantable electronic devices caused by diagnostic and therapeutic radiation 2. Medical physics particularly based on nuclear physics ***KUNITOMO Hiroshi*** My laboratory focuses on 1) image quality metrics for digital radiography 2) procedural optimization of dose metrics based on image quality 3) image quality metrics for mammography 4) image quality metrics for fluoroscopy 5) image quality metrics for cone-beam CT ***YASUI Keisuke*** 1. Proton dosimetry: Estimation of perturbation correction factors / Establishment of postal dose auditing in proton therapy 2. Establishment of Precision Medicine in radiotherapy: Investigation using cultured cells 3. Development of dosimetry devices using 3D printers 4. Performance verification of new technologies related to treatment planning systems

3）Field of Biomedical Engineering

Department of Biomedical Engineering

Course Title	Course Aims and Research Subject
Graduate Thesis of Biomedical Engineering HIBIYA Makoto IHIRA Masaru ITO Hiroyasu MIURA Yasuo FUJIGAKI Hidetsugu UMEZAWA Eizou HATTORI Hidekazu MIZUTANI Kenmei OHASHI Atsushi HIRANO Harutoyo HORI Hideo	***HIBIYA Makoto*** Extracorporeal circulation, as practiced by artificial heart-lung machines used in cardiac surgery, places the patient in a non-physiological setting. Disposable products and other products used for extracorporeal circulation have been improved in terms of biocompatibility. In addition, technologies for extracorporeal circulation have been developed that use the supply-demand balance of oxygen as an indicator. We will study the effects of these newer technologies. 1. Study on the effect of extracorporeal circulation on living body ***IHIRA Masaru*** Our research is mainly focused on rapid diagnostic methods using isothermal gene amplification. The main research themes are the multiplex LAMP method using gene chips and a novel gene amplification method for using microRNA as a novel biomarker. 1. The development of rapid diagnostic methods as new biomarker using miRNA for myocardial infarction. 2. Development of multiplex LAMP method using gene chips 3. Study for natural history of herpes virus or rotavirus ***ITO Hiroyasu*** We use immunological approaches to analyze the pathogenesis of cancer and develop new strategies for cancer therapy using small animal models and human specimens. 1. Development of novel cancer immunotherapy targeting immune checkpoint molecules. 2. Development of cancer vaccine therapy using tumor-bearing animal models. ***MIURA Yasuo*** The demand placed upon medical institutions entails the secure provision of advanced and highly specialized healthcare services, fostering an environment of confidence for patients seeking medical assistance. To remain at the forefront of the groundbreaking advancements resulting from the rapid progress in scientific and technological domains, dedicated endeavors are being undertaken to excel in the delivery, investigation, advancement, and education pertaining to state-of-the-art transfusion and cell therapies. 1. Pioneering the development of a robust and secure framework for transfusion medicine 2. Establishing a strong foundation for the forefront exploration of cutting-edge cell therapy methodologies ***FUJIGAKI Hidetsugu*** To develop companion diagnostics by predicting drug efficacy and side effects, we develop diagnostic agents targeting metabolism of amino acids and drugs. We also try to develop novel therapeutics for several diseases such as psychiatric disorders and cancer using metabolic enzyme inhibitors. 1. Development of therapeutic drugs and functional foods targeting enzymes in tryptophan metabolism 2. Development of biomarkers and diagnostic drugs by metabolomic analysis using mass spectrometry ***UMEZAWA Eizou*** Water molecules in living systems move around randomly in diffusion motion. Diffusion MRI uses its statistical properties to obtain information about tissue microstructure and function. We use physics, mathematics, and mathematical data science to study diffusion MRI. 1. Study on diffusion MRI 2. Study on mathematical and physical foundation of MRI, and new imaging and analysis methods of MRI based on it.

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Graduate Thesis of Biomedical Engineering HIBIYA Makoto IHIRA Masaru ITO Hiroyasu MIURA Yasuo FUJIGAKI Hidetsugu UMEZAWA Eizou HATTORI Hidekazu MIZUTANI Kenmei OHASHI Atsushi HIRANO Harutoyo HORI Hideo	***HATTORI Hidekazu*** To promote research that conducted in the field of radiology, which effectively utilizes artificial intelligence for informatics. 1. Study on automatic lesion detection in simple chest radiographs using Deep-Learning 2. Study on safety assurance when using contrast media ***MIZUTANI Kenmei*** Research on paralysis recovery and molecular mechanisms in the brain related to stroke rehabilitation and development of combined drug and rehabilitation therapy. 1. Analysis of plasticity changes in the brain using imaging devices 2. Identification of functional molecules by proteome analysis and elucidation of molecular mechanisms of paralysis recovery 3. Research on the development of combined rehabilitation and drug therapy ***OHASHI Atsushi*** The blood components of patients undergoing extracorporeal circulation therapy are under excessive oxidative stress due to the inflammatory response. Our laboratory analyzes and evaluates oxidative stress markers for biocompatibility between medical materials and blood. We are also developing treatments that improve biocompatibility. 1. Study on the effect of apheresis therapy on living body 2. Study on the effect of redox state of body fluid components on somatic cells ***HIRANO Harutoyo*** Development of devices to measure human physiological functions, and studies on physiological models and biomarkers based on engineering approaches. 1. studies on measuring vascular endothelial function. 2. study on the estimation of arterial stiffness using machine learning 3. measurements of autonomic nervous system response 4. study on monitoring systems for hospitalised patients. ***HORI Hideo*** Creation of novel regenerative therapy utilizing interactions between polymer materials and cells 1. A study on renal regenerative therapy using mesenchymal stem cells activated by polymer powder materials 2. A study on regenerative therapy using fiber materials