Table I-3 List of Research projects Conducted by Academic Advisors (Medical Sciences)

Educational area Responsible teacher Contact address	Research contents
Anatomy and Neuroscience （Anatomy） Professor ICHIJO Hiroyuki ichijo@med	We study structure, function, and evolution of neural circuits involved in animal behavior with taking advantage of in vivo and in silico methods. ・We investigate the structure and function of the habenula, which codes for aversive environments such as stress, in mice using anterior-posterior topography and maturation as clues. ・We investigate individual differences in neural circuits that respond to stress and their functional significance in mice. ・We investigate evolutionary mechanisms of innate attack and defense behaviors with using in silico individual-based models.
Molecular Brain Science （biochemistry） Professor INOKUCHI Kaoru inokuchi@med	We aim to resolve mechanisms underlying memory formation and also roles played by idling brain in subconscious in mammals by making full use of molecular biology, biochemistry, cell biology, histochemistry, electrophysiology, behavioral pharmacology, optogenetics, and live-imaging. ・Research on the physical substance of engram ・Research on the dynamics of engram ・Research on idling brain functions
Systems Function and Morphology Professor ITO Tetsufumi itot@med	We employ multidisciplinary approach to investigate functional and morphological basis of the brain which allows the coding of sensory information, especially sounds, and the sensory perception. Followings are the examples of the approach. (1) By combining neurophysiological and neuroanatomical techniques, the organization of neuronal circuitry which enable a specific function will be clarified. (2) We will identify functional, morphological, and molecular details of neuronal cell types which constitute a neuronal circuitry to establish functional standpoint of each cell type. (3) By comparing non-model animals which have unique specializations for sensory behaviors with model animals, details of the functional organization of sensory neuronal circuitry and its evolution will be clarified. (4) By manipulating specific elements of a given neuronal circuitry, relationship between changes of activation patterns of the neuronal circuit and behavioral changes will be clarified.
Diagnostic Pathology （Pathology） Professor HIRABAYASHI Kenichi hiraken@med	・Clinicopathological and molecular studies of biliopancreatic diseases ・Clinicopathological and molecular studies of neoplastic diseases ・Clinicopathological and molecular studies on inflammatory diseases ・Development of novel therapeutic approaches for pancreatic neuroendocrine neoplasms by targeting microRNAs ・Analysis of fusion genes in intraductal oncocytic papillary neoplasms
Molecular Immunology Professor KOBAYASHI Eiji ekoba@med	・Single cell analysis of B cell receptors (antibodies) and T cell receptors ・Elucidation of autoimmune disease mechanisms using autoantibodies ・Development of TCR-T therapy using tumor-specific T cell receptor (TCR) ・Development of cancer immunotherapy using chimeric antigen receptor (CAR) ・Development of novel T cell antigen identification method

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Molecular Neuropathology Associate Professor YAMAMOTO Seiji seiyama@med	・We promote a research to elucidate the function of platelet-derived growth factor receptor (PDGFR) in mice, especially neural tissue, neural stem cells, and blood vessels. ・We also conduct in vitro studies using cells isolated from such mice to elucidate that the PDGFR signal is involved in the regeneration and functional recovery of several organs and tissues. ・We create novel genetically engineered animals, such as knockout mice, to study intractable human diseases, to explorer and identify factors involved in disease progression, and promote research to develop novel treatment methods for patients.
Microbiology Professor MORINAGA Yoshitomo morinaga@med	・The role of microbiota on the colonization resistance against drug-resistant and/or pathogenic bacteria. ・The role of microbiota in the transmission of drug-resistant genes. ・The role of microbiota on the background of expansion of antimicrobial resistance beyond individuals. ・The modulatory effect of microbiota on viral infection. ・New concept for appropriate antibiotics use in the aspect of maintenance of commensal microbiota.
Molecular and Medical Pharmacology Professor NAKAGAWA Takashi nakagawa@med	・Elucidating how NAD metabolism is involved in the fundamental aging process. ・Implication of NAD metabolism in aging-related diseases, including cancer, neurodegenerative diseases and metabolic diseases. ・Development of anti-aging therapeutics targeting NAD metabolism. ・Elucidating pharmacological actions of KAMPO medicine using metabolomics analysis with LC/MS and GC/MS.
Epidemiology & Health Policy Professor SEKINE Michikazu sekine@med	Our mission is to conduct epidemiological studies and apply the results for health policy. To achieve this mission, we conduct several epidemiological studies. The Japanese civil servants study (the JACS study) comprises approximately 5,000 Japanese civil servants and aims to clarify whether socioeconomic factors, psychosocial stress at work, and work-life balance is associated with the development of poor physical and mental health. The JACS study is an international collaborative study with the British civil servants study (the Whitehall II study) and the Finnish civil servants study (the Helsinki Health Study). The Toyama birth cohort study (the Toyama study) is a birth cohort study of approximately 10,000 Japanese children. The MEXT Super Shokuiku School project comprises approximately 2000 children and their parents.　Both studies accumulate epidemiological evidence on health promotion from childhood. The Toyama Dementia Survey is an ageing and gerontological study of approximately 1000 adults aged 65 or more. Postgraduate students become members of the research units and are involved in each step of epidemiological research (i.e. study planning, and conducting, data analysis, and manuscript writing and publishing). The following is examples of current research topics. ・International comparative studies on the associations of psychosocial stress at work, work-life balances, health behaviors and personality characteristics with health ・International comparative studies on socioeconomic inequalities in physical and mental health ・Epidemiological study on the prevention of noncommunicable diseases from childhood ・Epidemiological study on the prevention of dementia

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Legal Medicine Professor NISHIDA Naoki nishida@med	・Pathology and molecular biology of cardiovascular disease ・Pathology and molecular biology of sudden infant death ・Neuropathology and associated molecular biology ・Pathology and molecular biology of suicide and neuropsychiatric diseases.
System Emotional Science Professor NISHIMARU Hiroshi nishimar@med	・Neural mechanisms of emotion, learning/memory, and behavioral expression in the limbic system ・Neural mechanisms of social cognition and non-verbal communication ・Non-invasive functional brain mapping of human higher brain functions ・Central control of autonomic nervous functions ・Neural mechanism of sensory perception and cognition ・Neuronal mechanism of sensorimotor integration underlying emotional behavior ・Neuronal mechanism of value-based decision-making ・Development and application of machine-learning based behavior analysis methods for animal models of neuropsychiatric disorders.
Molecular Neuroscience Associate Professor YOSHIDA Tomoyuki toyoshid@med	・Research on molecular basis of higher brain functions such as cognition, emotion, and sociality with generation of novel genetically modified mouse models. ・Research on the development of novel molecular imaging methods in the brain. ・Research on molecular basis of neuro-immune interactions. ・Research on molecular mechanisms of central synapse formation ・Research on pathogenic mechanisms of neurodevelopmental disorders
Health Professional Education Professor TAKAMURA Akiteru akiteru@med	The research in our lab is mainly focused on the education of medical professionals. Specifically, we will conduct research on the goals, strategies, and evaluation of under-graduate education, post-graduate education, lifelong education, and community healthcare education (including patient education) for physicians, nurses, pharmacists, and other healthcare professionals. Epidemiological studies on primary care are also possible. Quantitative research (e.g., descriptive statistics), qualitative research (e.g., thematic analysis and content analysis), and text mining will be used to explore educational effects in medical education.
Clinical and Cognitive Neuroscience Professor HAKAMATA Yuko hakamata@med	We aim at understanding the neurobiological mechanisms underlying emotional dysregulation associated with distorted cognitions, and using this understanding to develop novel, effective psychological interventions for anxiety and depressive disorders. We address these questions from the integrative view including psychology, cognitive behavioral science, endocrinology, immunology, genetics, and neuroscience. Lab members are expected to be engaged in research related to at least one of the following projects: 1) to examine the neurobiological mechanisms of biased cognitions towards emotional information; 2) to evaluate the efficacy of cognitive interventions including cognitive bias modification, cognitive training, and cognitive behavioral therapy for clinical and non-clinical population at high risk; and 3) to develop program tools to get the interventions easily accessible and doable. Participation in more than one project is encouraged.
Gene Expression and Regulation Associate Professor KAIDA Daisuke kaida@med	・Study on the effect of splicing abnormality on cell cycle progression ・Study on the effect of splicing abnormality on transcription elongation ・Study on the physiological functions of truncated proteins translated from pre-mRNAs ・Study on the mode of action of a ubiquitin-proteasome activator ・Study on the molecular mechanism that a ubiquitin-proteasome activator suppresses senescence

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Cardiology and Nephrology （internal medicine） Professor KINUGAWA Koichiro kinugawa@med	・Establishment of optimization protocol for the treatment of heart failure using various biomarkers ・Development of non-invasive home tele-monitoring system in order to minimization of re-hospitalization by heart failure ・Mechanisms of sympathetic nerve inhibition by non-pharmacological therapy for heart failure ・Introduction of novel staging of heart failure by cardiopulmonary function ・Development of novel strategy for heart failure to alter cardiac-specific gene・expression ・Investigation of relationship between beta-adrenergic receptors and reversibility of myocardial remodeling ・Exploitation of factors to determine the viability of renal collecting tubules ・Effect of renal denervation on autonomic disorders in heart failure model ・Mechanisms of onset of atrial fibrillation
Gastroenterology （internal medicine） Professor YASUDA Ichiro yasudaic@med	・Development of novel endoscopic techniques and devices for diagnosis of gastrointestinal diseases ・Development of novel minimally-invasive procedures for gastrointestinal diseases ・Molecular mechanism of colon hypo-sensitivity in constipation patients ・Molecular mechanism of enhanced intestinal epithelial permeability via digestive tract contents ・Immunological analysis of liver diseases and liver cancer and its application to the therapy ・Analysis of response for HBsAg to develop novel HB vaccine. ・Investigation of causal relationship between gut microbiota and the efficacy or toxicity of chemotherapy for gastrointestinal cancer ・Detection of aberrant DNA methylation in inflammation-associated carcinogenesis
Hematology （internal medicine） Professor SATO Tsutomu tsutomus@med	・Development of new drugs for multiple myeloma ・Exploratory research into molecularly-targeted therapy for T-cell lymphoma ・Prevention of bone mineral density reduction during lymphoma therapy ・Effects of osteoporosis on hematopoietic stem cells
Clinical Infectious Diseases Professor YAMAMOTO Yoshihiro yamamoto@med	・Establishing Surveillance System of MRSA with Molecular Microbiology ・Exploring Factors for Selection of antimicrobials against Chronic Pseudomonas Infection ・Analysis of Prognosticator of Non tuberculous Mycobacteriosis ・Study of Drug-Resistance Mechanism of Deep-seated Fungus Infection ・Gene Therapy for HIV infection

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Pediatric Developmental Medicine Professor IMAI Chihaya chihaya@med	In Department of Pediatrics, research projects to develop novel diagnostic and therapeutic strategies for intractable diseases in childhood and adolescents are performed. The research projects are set to investigate ways to solve the problems encountered in the clinics and the patient wards. The research projects include: · pediatric hematology/oncology, · pediatric immunology/allergology, · pediatric cardiology, · neonatology, · emergency pediatrics and pediatric intensive care, · pediatric nephrology and rheumatology, · pediatric infectious diseases, · pediatric neurology As an example, in the basic research conducted in pediatric hematology/oncology team of this department, we are working on the development of novel genetically engineered immune cell therapies for refractory and relapsed cancers and leukemias, which incudes the development of novel chimeric antigen receptor genes to improve the therapeutic efficacies of CAR-T cell therapy and the development of novel cell therapies by the use of genetically modified primary human NK cells.
Neuropsychiatry Professor TAKAHASHI Tsutomu tsutomu@med	· Brain imaging studies on pathophysiology of schizophrenia and their application to objective diagnosis of psychotic disorders · Neurophysiological studies in schizophrenia and related disorders · Pharmacotherapy to improve cognitive dysfunction in schizophrenia · Mechanisms of symptom development and preventive strategies for schizophrenia · Mechanisms of brain maturation, personality development, and sociality in adolescence · Early diagnosis and intervention for dementia
Radiation Oncology Professor SAITO Jun-ichi junsaito@med	· Free radical formation and DNA damage induced by ionizing radiation and ultrasound. · Molecular mechanisms of the enhancing of apoptosis and other types of cell death induced by ionizing radiation, hyperthermia, ultrasound and novel chemicals. · Regulation of gene expression by ultrasound · Development of radiation and ultrasound responsive promoters and its therapeutic applications. · Molecular and cellular responses to environmental stresses.
Cardiothoracic Surgery (Surgery) Professor YOSHIMURA Naoki ynaoki@med	· Surgical approach for arrhythmia · Clinical and biological research of lung cancer · Surgical approach for atherosclerosis · Surgery for ischemic heart disease · Mechanical assist for congestive heart failure · Surgery for congenital heart disease

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Cardiothoracic Surgery（Surgery） Professor TSUCHIYA Tomoshi tsuchiya@med	Through our transplantation and tissue engineering research, we have established a network with domestic and international research institutions to promote human exchange, joint research, and study abroad programs. (Collaborating institutions: Department of Biomedical Engineering at Yale University, Cincinnati University, RIKEN, Institute of Quantum Beam Science, Nagasaki University, Nagoya University, Department of Surgery for Organ Replacement and Xenotransplantation at Kagoshima University) The following is a list of major research projects. (Ref；https://www.organengineering.com/) ・Research on organ engineering using decellularized tissue skeletons ・Development of disease models using regenerated organs ・Development of disease models using lung organoids ・Induction of immune tolerance by cell therapy in lung transplantation models 　　～Cell therapy using regulatory T cells（Treg cells） 　　～Cell therapy using mesenchymal stem cells ・Research on development and disease control of lung mucinous adenocarcinoma ・Prediction of pleural invasion by intraoperative imaging using artificial intelligence
Department of Surgery & Science（Surgery） Professor FUJII Tsutomu fjt@med	・Clinicopathological analysis of the progression of gastrointestinal cancer ・Molecular-biological analysis of human cancers ・Analysis of biological response and its regulation of the surgical stress ・Clinical research for gastrointestinal and endocrine cancer ・Biomarker research on gastrointesitinal cancer, and development of precision medicine ・Development of novel surgical technique
Orthopaedics and Locomotor System Science Professor KAWAGUCHI Yoshiharu zenji@med	・Developmental biology of cartilaginous tissues ・Pathomechanism of joint and spine diseases ・Regenerative medicine for cartilage and intervertebral disc ・Origin of ossified lesions in spinal diseases ・Genetic and clinical analysis of spinal disorders ・Research on joint damage and therapeutic strategy for arthritic diseases ・Bone and soft tissue tumors ・Development of new surgical strategy and analysis of outcome ・Robotic surgery
Obstetrics and Gynecology Professor NAKASHIMA Akitoshi akinaka@med	・Molecular biology and immunology for reproduction ・Autophagy in placentation ・Molecular biology of growth and differentiation in trophoblasts ・Molecular biology and immunology for cervical cancers between with and without HPV infection ・Clinical diagnosis and therapy for preterm labor, preeclampsia and recurrent pregnancy loss ・Roles of autophagy for folliculogenesis
Ophthalmology Professor HAYASHI Atsushi ahayashi@med	・Inhibition of ocular angiogenesis and drug delivery ・Ophthalmic application of hyper-dried amniotic membrane ・Rapid diagnosis and treatment of ocular infectious diseases ・Quantitative analysis of eye movement and relationship to the diseases using the eye-tracker. ・Gene expression and biomarker research on ocular tumors ・To develop transplantation of ips derived retinal pigment epithelium

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Otorhinolaryngology - Head and Neck Surgery Professor MORITA Yuka yukam@med	We deal with diseases related to the sensory organs necessary for human life, as well as diseases related to breathing, swallowing, and sleep, which are important for maintaining life. In addition, it is necessary to treat all malignant tumors in the head and neck region while considering the preservation of their functions. In our department, we study the relationship between the sensory organs and brain functions, especially hearing and balance, establishing diagnostic and therapeutic methods for intractable middle ear diseases, and developing surgical treatments for nasal and paranasal diseases with emphasis on quality of life. In head and neck cancer treatment, we are conducting research directly related to clinical practice, such as the development of surgical methods for function preservation and the search for biomarkers for the selection of appropriate chemotherapy.
Urology Professor KITAMURA Hiroshi hkitamur@med	・Biomarker research on urological cancers ・Development of immunotherapy for urological cancers ・Cancer stem cell research on urologic cancers ・Growth factor research on prostate cancer ・Basic research on impaired spermatogenesis ・Research on vascular epithelial cells in erectile dysfunction ・Research on Heat Shock Protein in acute/chronic rejection after renal transplantation
Anesthesiology and Management During Perioperative Period Professor TAKAZAWA Tomonori takazawt@med	Our department conducts the following distinctive studies to ensure patient safety in the perioperative period. 1. Perioperative anaphylaxis research Anaphylaxis has been attracting attention as a potentially life-threatening event in recent years. We are engaged in epidemiological studies of perioperative anaphylaxis and the development of highly accurate anaphylaxis-causing agents. 2. Development of a model for predicting changes in vital signs using machine learning The vital sign monitors worn by patients during and after surgery provide a wealth of biometric information. We are developing a predictive model of vital sign fluctuations using machine learning, a truly innovative approach. 3. Research on the mechanism of anesthesia and the development of ideal anesthetics Although recent studies have elucidated the molecular basis of the target of anesthetics, the effects of anesthetics on the neural network are still unclear. We have developed a method that can capture the electrical activity of multiple interconnected neurons and are working on developing ideal anesthetics.
Comprehensive Oral Sciences Professor YAMADA Shin-ichi shinshin@med	・Research on pathological diagnosis and image diagnosis of oral diseases using artificial intelligence. ・Basic research on anticancer drug sensitivity using human oral squamous cell carcinoma cell lines. ・Basic research on cancer proliferation and invasion mechanisms using human oral squamous cell carcinoma cells. ・Immunological analysis using mouse oral squamous cell carcinoma model. ・Research on prevention of oral mucositis using human fibroblasts. ・Research on the development of minimally invasive oral cancer treatment. ・Research on the effects of oral bacteria on systemic diseases.

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Clinical Laboratory and Molecular Pathology （Clinical Laboratory Medicine） Professor NIIMI Hideki hiniimi@med	・Molecular pathophysiological analysis of diseases ・Development of the rapid identification and quantification test method for infectious pathogens (Tm mapping method) ・Development of rapid Antimicrobial Susceptibility Testing (AST) based on ATP fluorescence emission detection method ・Development of novel clinical testing technology
Japanese Oriental Medicine Professor KAINUMA Shigesaburo kainuma@med	・Elucidation of the mechanism of action of hachimijiogan for age-related diseases ・Objective evaluation of Kampo medicine diagnosis
Emergency Medicine Professor DOI Tomoaki doit@med	Research Interests The concept of "saving lives" in emergency medicine is the starting point of medicine. Therefore, emergency medicine is an area that all medical professionals should learn. Emergency medicine is a fight against rapidly evolving invasions, and the challenge is how to provide damage control treatment or definitive treatment within the time constraints and limited amount of information to save lives. The analysis of pathophysiology and establishment of treatment methods for invasions are the research targets of emergency medicine. Contents of instruction Research on sepsis (analysis of intracellular signaling pathways of platelets, analysis of vascular endothelial damage) Research on trauma (translational research between clinical and laboratory research) Research on acute blood purification therapy (research using electron microscopy) Research on hyperbaric oxygen therapy (laboratory research)
Clinical Oncology Professor HAYASHI Ryuji hsayaka@med	・Clinical practice of cancer genome medicine ・The effect of immune check point inhibitor and micro biome ・Epidemiology of the elderly cancer patients ・The different recognition between ordinary person and medical staff ・Immuno-oncology ・Cancer metabolism ・Cancer cell biology and target therapy ・Clinical study using medical records ・Statistical analysis with data base ・In vivo and in vitro experiments ・Cancer palliative care & herbal medicine

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Plastic, Reconstructive and Aesthetic Surgery Professor SATAKE Toshihiko toshi@med	・Vascular anatomy of perforator flaps ・Reconstruction using adipose stem cells and cultured adipose stem cells ・Regenerative medicine for sarcopenia: prevention and treatment ・Developing treatment for CRPS using sensory flaps ・Application of robotic microsurgery to various reconstructive procedures ・Pathogenesis and treatment of lymphedema
Computational Drug Design and Mathematical Medicine Professor TAKAOKA Yutaka ytakaoka@med	Our aims to construct theoretical medicine, which has an analogous concept of theoretical physics in contrast with experimental physics. It is not easy to describe the human body, that is, a complex system, with a hard science which uses mathematical models in such field as physics or chemistry. Therefore, we utilize molecular simulation analyses to describe human body partially, and use this approach to predict the future disease treatments. It is a challenge to evolve the medical system as a science with accumulated logic for prediction from the one which emphasizes experiences and results. Our final goal is to enable a paradigm shift from "validation" to "prediction" in the system of medical science. It is important to note that we pay attention whether the mathematical model is applicable to the real world and do not aim for mathematical sophistication. In addition, we also study the themes for Kampo and Acupuncture, machine learning and natural language processing, and social medicine such as community medical policies, improvement of hospital function, and medical management as follows: ・Prediction of adverse drug reactions base on molecular simulation and mathematical models ・Prediction of drug efficacy of molecularly target drugs for cancer based on molecular simulation and mathematical models ・Design of nucleic acid drugs and evaluation of drug efficacy ・Application of drug repurposing to computational drug design ・Molecular simulation analysis of pathological conditions caused by genetic mutations resulting in amino acid substitutions ・Molecular mechanisms of therapeutic effects of acupuncture and moxibustion ・Application of AI technologies such as machine learning and natural language processing to improvement of hospital functions ・Population dynamics and the future prediction of community medicine
Rehabilitation Medicine Professor HATTORI Noriaki hattorin@med	Rehabilitation medicine is one of the most active fields of translational research with fields such as basic medicine, neuroscience, and engineering. Incorporating the latest technology, we aim to create innovative rehabilitation medicine. Examples of specific research themes are listed below, but the research themes are not limited to these. We will discuss the research theme with students and flexibly determine the themes. ・Creation of objective indicators for rehabilitation medicine using new measuring instruments and analysis methods ・Development of neuromodulation methods to facilitate functional recovery ・Development of rehabilitation therapies aimed at improving activity of daily living (ADL) and quality of life (QOL) for various diseases ・Development of effective rehabilitation therapies for frailty, sarcopenia and malnutrition

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Innovative Clinical Research Professor CHUJO Daisuke dchujo@med	・Observational studies using the data from electronic health records ・Patient registry studies using electronic data collection systems ・Development of innovative medicine using the internet of things (IoT) for the treatment of diabetes ・Development of the systems for conducting clinical research, such as supporting systems for writhing protocols, medical statistics, medical ethics, data management, and clinical research coordination. ・Learning of medical data handling ・Total management of clinical research based on various regulations
Behavioral Physiology Professor TAKAO Keizo takao@cts	・Investigation of the physiological basis of learning, memory, emotion, and cognition ・Exploration and evaluation of mouse models of neuropsychiatric disorders using behavioral analyses ・Elucidation of the pathophysiology and development of therapies for neuropsychiatric disorders using mouse models ・Development of new genetically engineered mice ・Development of new reproductive technologies
Medical statistics Professor YONEMOTO Naohiro yonemoto@med	Development of epidemiological methods, statistical methods and applications for medicine and health. ・Transportability and generalizability in causal inference, Target trial emulation ・Design and analysis for new multiple data sources as clinical trials and real-world data, triangulation approach ・Modelling with complex design as joint model ・Methodology for systematic review and meta-analysis ・Analysis for health economics and outcome research ・Applications in Bayesian statistics, machine learning, natural language processing

※In addition to the above table, the following laboratories are also available.

　Integrative Neuroscience（Physiology）, Public Health & Environmental Medicine, Diabetes and Metabolism,Rheumatic andRespiratoryDiseases（internal medicine）, Dermatology, Diagnostic and Therapeutic Radiology（Radiation Oncology）, Neurosurgery, Neurology,

・A portion of email address is listed in the contact address. Please use it for preliminary consultations with the relevant academic advisor in the field of your choice. Please add ".u-toyama.ac.jp" after the address.
　　Example）abc@def　→　abc@def.u-toyama.ac.jp