

List of teacher research fields

<Biomedical Sciences>

Molecular Medical Sciences		
Research Area	Faculty	Research
Molecular and Cellular Physiology	()	<ol style="list-style-type: none"> 1. Cell injury by reactive oxygen species and the biological antioxidant systems. antioxidant systems. 2. Molecular functions of stress proteins. 3. Molecular mechanisms involved in spermatogenesis and sperm maturation.
Molecular Biological Oncology	IRIE Kenji HISATAKE Koji NISHIMURA Ken	Regulation of gene expression, cell polarization, and asymmetric cell division are critical for generating cellular diversity in development and differentiation of living organisms. These processes are dynamically regulated, and loss of their regulation is involved in the pathogenesis of human diseases including cancer. Our research focuses on the molecular mechanisms of transcriptional regulation, chromatin remodeling, mRNA localization, and translational control in development and differentiation using biochemical, cell biological, and genetic approaches. Roles of gene regulation in cell reprogramming and differentiation as well as development of an efficient system to induce reprogramming and differentiation.
Physiological Chemistry	KANAHO Yasunori OHBAYASHI Norihiko	Signal transduction systems, which are activated by a wide variety of agonists, such as hormones, neurotransmitters and growth factors, are important for homeostasis and pathogenesis. To understand these issues, we are focussing on the projects as follows: (1) Physiological functions of signal transduction pathways and its relation with pathogenesis; (2) Roles of signal transduction pathways in neuronal functions; (3) Involvement of signal transduction pathways in tumorigenesis and metastasis. (4) Development of novel anti-cancer drugs.
Molecular Neurobiology	MASU Masayuki	Our main research focus is to study the molecular mechanisms that regulate neural network formation and higher brain functions using integrative approaches, which include molecular biology, biochemistry, pharmacology, developmental biology, and neuroanatomy.
Anatomy and Embryology	TAKAHASHI Satoru	<ul style="list-style-type: none"> • Elucidation of molecular mechanism of pancreatic beta-cell development and its application. • Functional analysis of large Maf transcription factor family, MafB and c-Maf in macrophage development and functions. • Elucidating biological roles of carbohydrates using glycosyltransferase conditional KO mice. • Study of diseases and drug discovery by development of novel imaging system.

Human Medical Biology		
Research Area	Faculty	Research
Animal Models for Human Diseases and Comparative Medicine	SUGIYAMA Fumihiro	To establish model animals for virus-induced autoimmune diseases, study an interaction between virus and host cell factors, phenotypic modification of lymphoid cells induced by parvovirus, and anti-tumor activity of parvovirus. Also develop novel techniques of embryo engineering and microbiological monitoring of laboratory animals.
Experimental Pathology	KATO Mitsuyasu	Experimental study to elucidate the roles of transforming growth factor- β -related molecules in stem cell biology, tissue maintenance and carcinogenesis aiming for the establishment of novel molecular targeting therapy using macrocircular peptides. Multidisciplinary studies including, molecular cell biology, experimental pathology of genetically modified mice, three-dimensional quantitative tissue analysis, mathematical modeling, and analysis of protein structure will be conducted.
Cancer Signaling	Peter ten Dijke	Elucidate the underlying molecular and cellular mechanisms by which TGF- β and BMP growth factor signaling pathways are corrupted in cancer, vascular and other diseases. Develop therapeutic strategies to normalize the aberrant TGF- β /BMP signaling pathways using chemical biology approaches. We take a multi-disciplinary approach, employing peptide chemistry, molecular and cell biological techniques, molecular imaging in cultured cells and living animals, and leading edge proteomic and genomic technologies.
Diagnostic Pathology	NOGUCHI Masayuki	<ol style="list-style-type: none"> 1. Study about molecular mechanisms of multistep carcinogenesis including precancerous or background lesions 2. Applied medicine for prevention, early diagnosis and therapy of carcinoma based on the genome abnormalities detected in early carcinoma 3. Application of fetal protein to cancer diagnosis and therapy.
Kidney and Vascular Pathology	NAGATA Michio	We investigate the mechanism of progressive kidney disease, using human biopsy samples and feasible animal models. Particularly, pathophysiology of the glomerular filtration barrier and the mechanism of glomerulosclerosis from the view of podocyte biology. Unique pathology of renal vasculatures as a cause of renal disease is also our interesting point.
Immunology	SHIBUYA Akira	The goal of our research is to clarify the mechanisms of the immune system which plays a major role for immune defense against pathogens and cancer, using molecular and cellular biology and genetic engineering. In addition, we also give a challenge to understanding and control of failed immune system such as autoimmune diseases, allergy, graft rejection and graft-vs-host disease.

Research Area	Faculty	Research
Regenerative Medicine and Stem Cell Biology	OHNEDA Osamu	1) The molecular mechanisms of stem cell and stromal cell interaction is investigated related to hypoxic environment. Based on the knowledge, basic research for regenerative medicine will be developed toward cell therapy in the future. 2) The molecular mechanisms of cancer initiating cells and tumor vascularization is investigated under hypoxic conditions.
Infection Biology	KAWAGUCHI Atsushi	The molecular mechanism of virus replication and pathogenicity is examined based on the concept and methods of biochemistry and molecular biology. Virus-derived factors involved in the mechanism are identified, and their structures and functions are clarified. The role of host-derived factors in physiological cell state as well as infection cycle is understood. In addition, the molecular basis to know that host cellular anti-virus function and to establish the virus engineering is also studied metastasis.
Microbiology	MORIKAWA Kazuya	We study how pathogenic bacteria (especially, <i>Staphylococcus aureus</i>) cope with bactericidal factors from host and environment. Main focuses are the following: - Population heterogeneity: stochastic gene expression - Dynamics of cellular structures: nucleoid and membrane - Host-pathogen interaction in vitro
Molecular Parasitology	HO, KIONG	We are interested in understanding the mechanism of gene expression in protozoan parasites that is responsible for major public health concerns, such as Malaria and sleeping sickness disease, with a goal in identifying parasite-specific processes that can be exploited as targets for novel therapeutic interventions. Messenger RNA capping is an attractive target for anti-protozoan drug development because the enzyme responsible for cap formation is completely different between the parasite and the human host. We also aim to understand how damages in the RNAs are recognized and repaired in the cells. One of the few facts that have been established is that RNA ligase - an enzyme that joins the two ends of RNA together - is a key component of this repair process. Understanding of the function and mechanism behind cellular responses to RNA damage may also provide useful therapeutic targets, as breakage in the RNA accumulate in cancer cells and during stress condition.
Neurophysiology	KOGANEZAWA Tadachika	We are electrophysiologically approaching to mechanisms of cardiovascular and respiratory regulation by the central nervous system using in vivo and in situ preparation of rodents. At present, we are especially studying that: • Cardiovascular regulation by the central nervous system • Mechanisms of the neurogenic hypertension • Respiratory regulation by the central nervous system

Research Area	Faculty	Research
Cognitive and Behavioral Neuroscience	MATSUMOTO Masayuki	The goal of our research is to understand neural mechanisms underlying psychological phenomena such as attention, emotion, memory, learning and decision making. In particular, we are investigating the role of monoamine systems, such as dopamine and serotonin, in cognitive functions. Using electrophysiological and pharmacological techniques, we are identifying monoamine signals associated with cognitive processing and are examining how the signals promote cognitive operations. These studies will provide more mechanistic accounts of cognitive disorders.
Medical Physics	SAKAE Takeji	<ol style="list-style-type: none"> 1. Improving quality and reliability in X-ray and particle radiotherapy. 2. New treatment technique using an accelerator. 3. New technique for quality control in medical applications of radiation. 4. New calculation method to estimate proton-induced dose distribution in the body of the patient.
Radiobiology	TSUBOI Koji	<ul style="list-style-type: none"> •Molecular and cellular effects of high-energy proton beams •Development of novel radiosensitizing agents based on DNA repair mechanisms •Effects of local radiation on cancer immune response
Biomedical Engineering	MIYOSHI Hirotochi	The aims of our researches are development of bioartificial organs, e.g., ex vivo expansion systems of hematopoietic stem/progenitor cells, bioartificial livers, and bioartificial vascular grafts, from the viewpoint of tissue engineering. Establishment of basic technologies required for these developments is also our interest.
Vascular Biology	YANAGISAWA Hiromi	<ul style="list-style-type: none"> - Identification and functional analysis of novel extracellular matrix proteins (ECM) proteins in the vessel wall. - Investigation of impaired ECM-Cell interactions in vascular matrix diseases and development of novel therapeutic strategies. - Molecular mechanism of mechanotransduction in the vessel wall.

Genome and Environmental Medicine		
Research Area	Faculty	Research
Molecular Genetic Epidemiology and Public Health Medicine	TSUCHIYA Naoyuki	<ul style="list-style-type: none"> • Genomic analysis of human autoimmune rheumatic diseases for the identification of susceptibility genes and biomarkers • Molecular mechanisms of autoimmune disease-associated genes
	YAMAGISHI Kazumasa	<ul style="list-style-type: none"> • Public health practice and epidemiological evaluation of lifestyle-related disease prevention program in communities (speaking proficiency of Japanese required) • Management of community-based genome cohort study of lifestyle-related diseases
	SAKATA Yumiko	<p>Health care for adolescence and collaboration with health related divisions.</p> <p>Self-esteem and health.</p> <p>Care of elderly people with dementia.</p> <p>Community health nursing and school health nursing.</p>
Genetic Medicine	NOGUCHI Emiko	<p>Human genetics and genomics research including genome-wide linkage and association analyses and epigenetic analyses. Allergic diseases such as bronchial asthma, atopic dermatitis, seasonal rhinitis, and food allergy are the main targets of our research. Identification of the disease-causing mutation of genetic diseases by next generation sequencers can be performed.</p>
Environmental Medicine	KUMAGAI Yoshito	<p>We have been examining the reactivity and toxicology of environmental electrophiles such as polycyclic aromatic hydrocarbon quinones (contaminated in the atmosphere), arsenic (contaminated in groundwater) and methylmercury (contaminated in fish) in an effort to establish mechanistic pathways that may account for the adverse health effects. The main purpose of our study is to identify molecular targets (e.g., redox sensors) for these chemicals because such environmental electrophiles are covalently bound to protein nucleophiles, and to elucidate adaptive response to the environmental electrophiles, resulting in the decreased toxicity.</p>
	MATSUZAKI Ichiyo	<p>We study interactions between environments and human health, especially focusing on work environment.</p> <ul style="list-style-type: none"> • Practical research on the mechanisms of health problems caused by workplace stress factors and the risk management system • International collaboration with Norwegian researchers for stress coping capacity building • Research on the effects of rework program in return-to-work from depression

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Molecular and Developmental Biology	KOBAYASHI Makoto	Major interests in our lab are 1) how cell fate decisions are made in multipotential hematopoietic progenitors, and 2) how cells regulate cellular defense against a variety of stress, such as oxidative stress and ER stress. To solve these mysteries at the molecular level, we use techniques of zebrafish genetics and molecular biology. We also start to explore the potential utility of the zebrafish as a model for gerontology.
Legal Medicine	HONDA Katsuya	To settle the medical problems concerning the law, we perform the practice and research as below; Practice: medico-legal autopsy, forensic pathology, toxicology and testing of haemogenetics; Research: studying the genesis of internal and external death, exploring for personal identification on molecular level.
Genome Biology	MURATANI Masafumi	Integrative genome and epigenome analysis of clinical samples to understand mechanisms of cancer development and for discovery of new drug targets and biomarkers. Cell-free DNA and RNA profiling to monitor environmental stress responses in internal tissues.

Medical Science of Sleep		
Research Area	Faculty	Research
Behavioral Neuroscience	YANAGISAWA Masashi	Elucidation of fundamental mechanisms for sleep/wake regulation ①Large-scale, forward genetic screening of genes responsible for sleep/wake regulation in mice ②Discovery and medicinal chemistry of novel drugs for sleep disorders ③Visualizing and manipulating the activity of neurons involved in sleep/wake regulation
Functional Neuroanatomy	FUNATO Hiromasa	Combined approaches using viral vectors and gene-modified mice to uncover neural circuits underlying sleep/wakefulness behavior, feeding and body weight homeostasis, and anxiety and depressive behavior.
Medicinal Chemistry / Organic Chemistry	NAGASE Hiroshi KUTSUMURA Noriki	Design and synthesis of orexin receptor agonists. Design and synthesis of opioid ligands. Research and development of drugs for narcolepsy. Research and development of drugs for severe pain, depression, pollakiuria, malaria, other protozoal diseases, and cancer.

Research Area	Faculty	Research
Biochemistry / Chemical Biology / Genetics	LIU, Qinghua	<p>Integration of biochemical, chemical biological and genetic approaches to identify molecular mechanism of sleep and fear in mice.</p> <ul style="list-style-type: none"> • Quantitative analyses of wild-type and sleep mutant brain proteome and phosphor-proteome to reveal the molecular circuit of sleep. • Development of novel and rapid technology for adult-and brain-specific knockdown (or knockout) of candidate sleep and fear genes. • A large-scale forward genetic screen to identify the fearless mutant mice to elucidate the molecular basis of fear and related mental disorders.
Sleep Learning Science	SAKAGUCHI Masanori	<ol style="list-style-type: none"> ① The mechanisms of circuit integration of new neurons for brain regeneration ② Function of sleep in integration of new born neuron into memory circuits ③ Function of sleep in memory consolidation revealed by optogenetics
Systems Sleep Biology	LAZARUS Michael	<ol style="list-style-type: none"> 1) Use of genetically engineered systems to dissect neural circuitry regulating sleep and wakefulness 2) The mesolimbic brain system in the control of sleep and wakefulness 3) Motivated behavior as a sleep-regulating factor
Molecular Sleep Biology	URADE Yoshihiro	<ol style="list-style-type: none"> 1) Elucidation of molecular mechanisms of sleep-wake regulation by endogenous sleep-substances 2) Screening of natural components and chemicals with sleep-wake regulatory activities 3) Developments of social sleep-monitoring network and sleep data base.
Neuroscience	Vogt, Kaspar	<p>Analysis of neural circuits dynamics in awake and sleeping animals using in-vivo electrophysiology and functional imaging. We are focusing on the cortical neural networks producing deep, so called slow-wave sleep and the mechanisms of its homeostatic</p>
Brain maturation/ evolution	HAYASHI Yu	<ol style="list-style-type: none"> 1) Elucidation of the function of sleep focusing on brain maturation and aging 2) Elucidation of the evolutionary process of sleep based on molecular and developmental approaches

【Cooperative Graduate School】(Applicants for the Special Selection of Working Individuals Examination cannot choose a faculty member of the Cooperative Graduate School System as their supervisor.)

(Sub) indicates the Sub-Supervisor.

Research Area	Faculty	Research
Functional Genomics (RIKEN)	ISHII Syunsuke NAKAMURA Yukio [(Sub)TAKAHASHI Satoru]	Transcriptional control is a key step in development, stress response, and various diseases of human beings. Recent progress in the study of the mechanism of cellular proliferation has shown that signals for proliferation or differentiation are transferred into nuclei through receptors and other mediators. However, the mechanism of signal transduction remains elusive, in particular, how transcription is regulated via change in nuclear architecture and chromatin structure. Through the use of molecular biology and biochemistry techniques and, in some cases, employing whole animal systems, we are investigating the mechanism of transcriptional control.
International Medicine (NCGM)	KANO Shigeyuki [(Sub)KAWAGUCHI Atsushi]	To conduct the researches on International Medicine of global importance particularly on emerging and re-emerging infectious diseases which require international cooperation for their containment. Such socio-economic researches on human behavior or habitat, population movement, ecological or environmental factors are also indispensable for the control of the disease. Many issues on the poverty, hunger, malnutrition, education, water safety, gender discrimination, vaccine or drug production in the context of Global Health are to be clarified and resolved to achieve “Universal Health Coverage”.
Virology (NIID)	KURANE Ichiro [(Sub)KAWAGUCHI Atsushi]	<ul style="list-style-type: none"> ·Pathogenesis of dengue hemorrhagic fever. ·Protective immune mechanisms against hemorrhagic febrile viruses. ·Development of new type of vaccines against flaviviruses. ·Molecular epidemiology of hemorrhagic fever viruses.
Protein Metabolism (TIM)	TANAKA Keiji [(Sub)KANAHO Yasunori]	Proper turnover of cellular protein is essential for cellular homeostasis, and the defect leads to various serious diseases. Our current study aims to clarify the action mechanisms and pathophysiology of the proteasome who is a key player of intracellular protein recycling systems and together with the ubiquitin and autophagy (self-eating) systems.

(RIKEN) = RIKEN Tsukuba Research Laboratories

(NCGM) = National Center for Global Health and Medicine

(NIID) = National Institute of Infectious Diseases

(TIM) = Tokyo Metropolitan Institute of Medical Science