# Research Fields

2026

KANSAI MEDICAL UNIVERSITY



Professor
Masaaki Kitada

## Research Field : Functional Morphology and Regenerative Biology (Department : Anatomy)

【Research Fields】

1. Researches focusing on regeneration of damaged tissues using regeneration-competent animals that achieve functional reconstruction by spontaneous regeneration (Kitada, Hayashi, Seki, and Nakano)
   While the tissue regeneration ability of mammals is limited, “regeneration-competent animals” such as fish and amphibians exhibit spontaneous regeneration after tissue damage to achieve functional reconstruction. We are studying the mechanism of spontaneous regeneration in regeneration-competent animals in anticipation of its future application to humans.

2. Neurogenesis by cell fate manipulation (Kitada, Hayashi, and Nakano)
   Our research aims to create new nerve cells at the sites, where they are needed, by artificially regulating the cell fates of native stem and progenitor cells, which will be beneficial for the treatment of neurodegenerative diseases and damages of neural tissue.

3. Dynamics and functional analysis of glycolipids in neural development (Hirahara)
   We analyze the role of glycolipids in the development and disease of tissues, focusing on the nervous system, with the use of a variety of research techniques, particularly imaging mass spectrometry.

4. Functional analysis and therapeutic research on the genes expressed in glioma (Oe)
   Our research focuses on microRNA and long non-coding RNA, which are specifically expressed in cancer stem cells, toward the development of new treatments for glioblastoma, which is the most malignant brain tumor.

5. Functional analysis of novel nerve cells in dorsal root ganglion (Koike)
   The dorsal root ganglion (DRG) is comprised of neurons (ganglion cells) and Schwann cells of the peripheral nervous system. We have been exploratoring the functino of a novel subtype of ganglon cells and novel glial cells present in DRG.

【Attainment goals】

1. Understanding the previous reports and backgrounds of a topic and learning applicable methodologies to contribute to the theme.
2. Learning the basic morphological and functional aspects of target organs and target stem/progenitor cells.
3. Independently flormulating the research plan, performing the experiments, and developing the research.
4. Mastering morphological methods and their theories and developimg the ability to correctly interpret experimental results.
5. Summarizing research results, making the oral presentation, and reporting them as a paper.
6. Taking in the opinions of others and flexibly responding in conducting research.



Professor
Kae Nakamura

## Research Field : Cognitive Neuroscience (Department : Physiology)

【Research Fields】

Our laboratory aims to elucidate the neurological substrates of cognitive functions and behaviors. In neuroscience, in addition to studying function at the genetic, molecular, and cellular levels, we must clarify how these parts function as a circuit, connecting to real behaviors. To this end, we utilize electrophysiological and pharmacological approaches, as well as computational analysis in primates performing rigorously planned behavioral tasks. Furthermore, our laboratory incorporates optogenetic techniques, a rapidly developing technique in rodent models. Currently, we are exploring (1) the decision-making mechanism based on reward, punishment, stress; and risk information and the roles of neurotransmitters, such as dopamine and serotonin, and (2) the neural mechanism of social emotional information processing. We are also conducting joint research with clinical departments, such as the Departments of Rehabilitation and Pediatrics.

【Research Goals】

1. To understand the neural basis of cognitive functions, such as perception/movement and memory/learning.
2. To be able to plan and carry out neurophysiological experiments using humans and animals.
3. To be able to analyze data mathematically and explain it logically.
4. To be able to publish research results at conferences and as papers.



Professor
Takuya Kobayashi
(Shimizu)

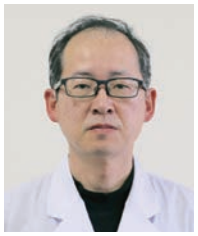
## Research Field : Biomolecular Structural and Medical Sciences (Department : Medical Chemistry)

**【Research Fields】**

The Medical Chemistry Department within the Faculty of Medicine aims to understand the chemical reactions of biomolecules that control life phenomena, and to make use of them in medicine. With protein science (such as structural biology and biochemistry) and neuroscientific approaches, we examine the physiological and pathophysiological roles of protein molecules in living organisms by analyzing their functions from the atomic to individual levels. We explore and design chemical substances and molecules that control protein molecules that could be potential drug targets. Our research methods include various approaches from classical column chromatography protein purification to using columns to genome editing, structural analysis, molecular imaging, and behavioral analysis. While new discoveries are always needed in basic medical research, striving to be the first group with such breakthroughs is never easy. Grit, determination,, as well as colleagues who partner to overcome challenges together, are essential. Such experiments require flexible creativity, thinking power, innovative ideas, and abilities to take action and not miss opportunities. Many colleagues in the Department of Medical Chemistry have research backgrounds in different fields. In this department, we aim for historic discoveries of novel drugs, thereby contributing to the next generation.

**【Research Goals】**

1. To be able to collect necessary information from reliable sources and derive unknown problems.
2. To be able to understand the principles of basic experimental techniques and use the techniques to solve the derived problem.
3. To be able to make an experimental plan for solving the problem, examine the results of the experiment that has been carried out, and plan for the next experiment.
4. To be able to draw conclusions from a series of experimental results and publish them externally at conferences and as scientific papers.



Professor
Tomoyuki Nakamura

## Research Field : Molecular Pharmacology, Matrix Biology and Medicine (Department : Pharmacology)

**【Research Fields】**

With the development of drug design and antibody drugs, there is an increasing number of means to inhibit or promote the function of target molecules in the living body. We believe that the most important task for the Department of Pharmacology of the Faculty of Medicine in such an era is to identify the target molecules that play an important role in the living body or in disease. This requires a wide range of research techniques, such as biochemical/molecular biology methods, cell biology methods, and generation/analysis of genetically modified mice. We are conducting innovative research on novel target molecules by making full use of these cutting-edge life science techniques. The main theme of our research is to study the mechanism of formation and regeneration of elastic fibers, which are components of extracellular matrix. With this study, we aim to identify novel target molecules for aging-related diseases, such as emphysema and arteriosclerosis. In addition, our lab members have developed their own research themes suited to their interests, including the functions of sugar chains in the living body, the molecular mechanism of cardiac development, and circadian rhythm and cancers.

**【Research Goals】**

1. To learn molecular biology techniques using DNA, RNA, and proteins.
2. To learn cell biology techniques using cultured human and mouse cells.
3. To learn the methodology for generating, maintaining, and analyzing genetically modified mice.
4. To be able to find the literature that contains the experimental methods necessary to carry out his/her research project.
5. To be able to make an experimental plan that can produce meaningful results and analyze and interpret the data correctly.
6. To be able to present research content appropriately.
7. To be able to publish research content as papers in English.



Professor
Koji Tsuta

## Research Field : Pathology and Laboratory Medicine (Department : Pathology)

【Research Fields】

In our department, we aim to develop new diagnostics and treatments based on the histopathological findings obtained in actual clinical practice. Using technologies such as tissue microarray and next-generation sequencing, we perform a wide range of proteomic and genomic, searching for biomarkers related to prognosis and treatment selection. Furthermore, we test our hypotheses based on molecular pathological analysis using engineering methods combined with biological models. We have revealed the carcinogenic mechanisms, metastases, and cancer microenvironment of a wide variety of carcinomas, such as those affecting respiratory organs, urinary renal organs, mammary glands, female reproductive organs, and the head and neck region, and reported findings that led to improved prognosis for patients. Recently, we have focused on precise tumor progression analysis by constructing tissues three-dimensionally using a 3D printer, as well as the construction of a diagnosis and prognosis prediction system using artificial intelligence technology in collaboration with the department of genome analysis. Therefore, we are focusing on practical research that leads to the realization of better treatment and appropriate diagnosis, including morphological, protein, and genetic abnormalities.

【Research Goals】

1. To understand adult tissue stem cells that support cellular metabolism to maintain normal structure and tissue homeostasis.
2. To be able to understand the pathological morphology of typical tumors and lesions.
3. To be able to use immunohistochemical and molecular biology methods properly and to troubleshoot.
4. To set a research topic and understand the necessary theory and matters that have been revealed previously.
5. To present research content appropriately.
6. To publish research content as peer-reviewed studies in English.



Professor
Kazu Okuma

## Research Field : Viral Oncology (Department : Microbiology)

【Research Fields】

It seemed that humanity was gradually freed from the threat of infectious diseases due to the rapid development of modern microbiology, which began in the early 20th century. However, as we learned from the COVID-19 pandemic caused by the new coronavirus (SARS-CoV-2), fighting new pathogenic microorganisms remains a major challenge for humanity, and even many known infectious diseases, such as Ebola, cause a number of casualties in each epidemic. A weapon to combat these emerging and re-emerging infectious diseases is basic research in the field of microbiology. Microbiology has become not only the starting point for the development of today's molecular genetics/biology and immunology but also the basis for discovering new phenomena and principles of life, which has also led to the development of current vaccines for COVID-19.
Why don't you learn the latest knowledge and technology in our laboratory and contribute to the world? We are currently studying the pathogenic mechanism and treatment of adult T-cell leukemia (ATL) and neurological disease (HTLV-1-associated myelopathy, HAM), which are the infectious diseases associated with human T-cell leukemia virus type 1 (HTLV-1), the first human pathogenic retrovirus discovered, mainly using animal models. In addition to these, we hope to tackle emerging and re-emerging infectious diseases, such as COVID-19, in the future.

【Goals】

1. To understand the changes in cellular functions due to viral infection and host immune response.
2. To understand the mechanisms of cellular tumorigenesis and antitumor immunity.
3. To learn technologies of gene and protein expression analysis using molecular biology techniques.
4. To learn technologies of blood cell and viral infection analysis using cell biology techniques.
5. To set a research topic and understand the necessary theory and previous findings.
6. To perform statistical analysis based on experimental data.
7. To present the research content appropriately.



Professor
Hirofumi Hitomi

## Research Field：Regenerative Medicine （Department：iPS Cell Regenerative Medicine）

**【Research Fields】**

The Department of iPS/Stem Cell Regenerative Medicine is a multidisciplinary team that unites experts in regenerative medicine research focused on the heart, liver, kidney, endocrine organs, blood, and skeletal muscle. Our three main goals are as follows:

1. Developing differentiation induction methods using induced pluripotent stem (iPS) cells.
   We are developing and improving methods for differentiating human iPS cells into various cell types. We have been studying methods of inducing differentiation into neuron, eye, heart, liver, kidney, pancreas, blood vessels, endocrine organs, skeletal muscle, skin, bone, and blood cells.

2. Generating disease models to elucidate mechanisms.
   We generate disease models by inducing differentiation of human iPS cells. Although recreating human diseases in vitro is challenging, we study disease mechanisms using pathological models created with newly derived human iPS cells. Additionally, we establish iPS cells from patients to investigate their pathophysiology and develop treatment strategies.

3. Aiming for clinical application.
   Cells derived from human iPS cells are used for drug screening and efficacy testing. Our goal is not only to evaluate drugs but also to discover new ones. Additionally, we aim to develop regenerative medicine, including cell therapy.

**【Research Goals】**

1. Understand the latest research trends in regenerative medicine by carefully reading research papers and participating in seminars and conferences
2. Learn and understand the use of laboratory notebooks, manage experimental data, plan experiments, research ethics, and similar topics
3. Be able to identify issues from previously published regenerative medicine research and develop a research plan
4. Learn the basic techniques of regenerative medicine research to execute the research plan
5. Learn and understand how to apply for research grants and obtain external funding
6. Be able to present research in an appropriate manner
7. Publish research in the form of academic papers in international academic journals



Research Professor
Fumiyuki Hattori

## Research Field：Innovative Regenerative Medicine （Department：iPS Cell Regenerative Medicine）

**【Research Fields】**

In our department, Innovative Regenerative Medicine, we are developing novel regenerative medicines for the heart, liver, digit (fingertip), and salivary gland, as well as the discovery of novel pharmaceutical targets, including atopic dermatitis, myasthenia gravis, cystic fibrosis, long covid, and aging. We utilize human-induced pluripotent stem (iPS) cells for research combining various omics technologies, including sophisticated mass spectrometry, metabolomics, and next-generation sequencing. Furthermore, the application of AI and robotics is included in our research focus based on our collaborations with several industrial companies.
We are highly active in making patents and publications in international journals. We do not want to stay in the narrow specialty but rather to expand our own research field based on our curiosity.

Recent Publication (2023-2025)


1) Establishment and characterization of an induced pluripotent stem cell line from a Japanese cystic fibrosis patient with homozygous 1540del10 CFTR mutation. Okumura H, Hayashi M, Yamashita H, Hattori F. Genes Dis. 2024 Dec25;12 (5):101506. PMID: 40485979
2) Lgr6-expressing functional nail stem-like cells differentiated from human-induced pluripotent stem cells. Inomata Y, Kawatani N, Yamashita H, Hattori F. PLoS One. 2024 May 14;19(5):e0303260. PMID:38743670
3) Correlation of interferons and autoimmune aspects in long COVID-19 patients. Hattori F, Nishiyama J, Hasuo H. Int Immunol. 2025 May 21;37(6):355-363. Int Immunol. 2025 Aug 12:dxaf044. PMID: 39921694
4) An Automated Culture System for Maintaining and Differentiating Human-Induced Pluripotent Stem Cells. Bando K, Yamashita H, Hattori F. J Vis Exp. 2024 Jan 26;(203). PMID: 38345218.
5) Machine learning discriminates P2X7-mediated intracellular calcium sparks in human-induced pluripotent stem cell-derived neural stem cells. Hanafusa Y, Shiraishi A, Hattori F. Sci Rep. 2023 Aug 4;13(1):12673. PMID: 37542080
6) A Novel Cell Injection Method with Minimum Invasion. Hattori F. J Vis Exp.2023 Apr 21;(194). PMID: 37154546.
7) Application of Live Mitochondria Staining in Cell-Sorting to Purify Hepatocytes Derived from Human Induced Pluripotent Stem Cells. Yamashita H, Hattori F. J Vis Exp. 2023 Dec 1;(202). PMID: 38108371.
8) Human Induced Pluripotent Stem Cell-Derived Keratinocyte-Like Cells for Research on Protease-Activated Receptor 2 in Nonhistaminergic Cascades of Atopic Dermatitis. Nishimoto R, Kodama C, Yamashita H, Hattori F. J Pharmacol Exp Ther. 2023 Feb;384(2):248-253. PMID: 36351795


**【Research Goals】**

1. To understand the current status and unsolved problems of regenerative medicine research.
2. To understand the embryological origin of organs, tissues, and cells to be treated.
3. To understand the causes and exacerbation mechanisms of diseases to be treated.
4. To be able to interpret experimental results independently and guide the research plan.
5. To be able to publish research results at conferences and as papers.



Professor
Katsuyasu Kouda

## Research Field : Public Health (Department : Hygiene and Public Health)

**【Research Fields】**

As its main research theme, Epidemiology and Preventive Medicine is currently working on the research on the prevention of non communicable diseases for community-dwelling people, which include cardiovascular diseases, glycolipid metabolic diseases, and osteoporosis. We are also conducting epidemiological studies on the prevention of infectious diseases, such as tuberculosis. Epidemiological studies aim to analyze various factors affecting health and illness through data from large-scale surveys of community-dwelling people. Of those factors, beneficial and harmful ones are quantified to derive measures aiming to enhance the former and attenuate the latter. The results of the studies can be directly returned to the real world, in addition to satisfying our academic interests. Furthermore, epidemiological studies also aim to clarify the overall picture of diseases and the factors that determine their onset, course, and outcome using clinical data from health and medical services, and to show the intensity and magnitude of the effects of each factor quantitatively. Therefore, epidemiology provides physicians with the scientific evidence necessary for considering the medical treatment policy of their patients in the medical field in the real world.

**【Goals】**

1. To learn the methods to conduct large-scale surveys of people.
2. To learn the methods to control bias in relatively small data, such as clinical data.
3. To learn techniques from the handling of raw data to aggregation, statistical analysis, interpretation of results, and writing of papers.
4. To learn the theories and methods in statistics necessary for evaluating medical data.
5. To learn the methods to implement health care based on scientific evidence.



Professor
Katsuyasu Kouda

## Research Field : Epidemiology and Preventive Medicine (Department : Hygiene and Public Health)

**【Research Fields】**

As its main research theme, Epidemiology and Preventive Medicine is currently working on the research on the prevention of lifestyle-related diseases for local residents, which include cardiovascular diseases, glycolipid metabolic diseases, and osteoporosis. We are also conducting epidemiological studies on the prevention of infectious diseases, such as tuberculosis.
Epidemiological studies aim to analyze various factors affecting health and illness through data from large-scale surveys of local residents. Of those factors, beneficial and harmful ones are quantified to derive measures aiming to enhance the former and attenuate the latter, which are then evaluated. The results of the studies can be directly returned to the real world, in addition to satisfying our academic interests.
Furthermore, epidemiological studies also aim to clarify the overall picture of diseases and the factors that determine their onset, course, and outcome using clinical data from medical institutions and to show the intensity and magnitude of the effects of each factor quantitatively. Therefore, epidemiology provides physicians with the scientific basis necessary for considering the medical treatment policy of their patients in the medical field in the real world.

**【Goals】**

1. To learn the methods to conduct large-scale surveys of people.
2. To learn the methods to control bias in relatively small data, such as clinical data.
3. To learn techniques from the handling of raw data to aggregation, statistical analysis, interpretation of results, and writing of papers.
4. To learn the theories and methods in statistics necessary for evaluating medical data.
5. To learn the methods to implement health care based on scientific evidence.



Professor
Tatsuya Noda

## Research Field : Healthcare Data Science (Department : Public Health Informatics)

【Research Fields】

We utilize large-scale medical data to conduct clinical studies across a wide range of areas, such as infectious diseases (including influenza and HIV), cancer, intractable diseases, allergic disorders, perinatal conditions, and dialysis medicine.
Database-based clinical research is a new style of study that analyzes big data. Through these analyses, we address diverse issues such as disease incidence, prognosis, treatment outcomes, patient behavior, and healthcare costs. Although the insights gained from such studies can be substantial, researchers are expected to design their studies independently. This requires a solid understanding of the Japanese healthcare system, logical reasoning skills, and persistence.
To join this research field, the first requirement is to already have a good understanding of Japan's healthcare and reimbursement systems, or the ability to acquire such understanding within a short period. The second requirement is to have multiple, clearly defined clinical questions (CQs) in the field of clinical medicine. Compatibility between CQs and database research is essential.

【Research Goals】

1. To acquire the ability to design and conduct clinical epidemiological studies using large-scale claims databases.
2. To develop advanced analytical skills for disease-specific research utilizing medical big data, leading to the generation of clinically meaningful evidence.
3. To understand and apply methods of health economics analysis using medical big data, enabling evaluation of healthcare efficiency and policy impact.



Professor
Atsushi Akane

## Research Field : Forensic Science (Department : Legal Medicine)

【Research Fields】

In our department, judicial autopsies are commissioned from the Osaka Prefectural Police Headquarters and the Osaka District Public Prosecutors Office to investigate the causes of death of criminal cadavers. DNA variants, drugs and poisons in the bodies are also analyzed. Personal identification is performed by DNA profiling. For the forensic purposes, we are developing three researches as follows:

1. Forensic application of the next-generation sequencing: We study applicability of the technology analyzing hundreds to thousands gene variants simultaneously to personal identification and detection of genetic predispositions of fatal diseases.

2. Development of a probabilistic genotyping method to interpret DNA profiles derived from DNA mixtures: We are developing a probabilistic genotyping software to detect DNA profiles of suspects and victims in the STR (short tandem repeats) electropherograms, and verifying its usefulness in actual cases of DNA profiling.

3. Study on the effects of synthetic cannabinoids: We are studying pharmacokinetics of synthetic cannabinoids, known as dangerous synthetic drugs in Japan, in blood and brain of laboratory animals and researching the inducing effect of catalepsy.

【Research Goals】

1. To be able to understand the phenomenon of human death and the pathophysiology of fatal injuries, asphyxiation, poisoning, and diseases.
2. To be able to understand the principles and methods of personal identification.
3. To be able to retrieve and read research papers to design the research theme and the experimental methods.
4. To be able to analyze experimental results statistically.
5. To be able to present research findings appropriately.



Distinguished Professor
appointed by the University
President
Yuko Kiyosue

## Research Field : Molecular Immunology (Department : Molecular Genetics)

【Research Fields】

1. Research on the pathogenesis of immune diseases caused by abnormal immune cell trafficking.
2. Research on signal transduction mechanisms regulating immune cell trafficking.
3. Molecular dissection of cellular transformation and identification of diagnostic and therapeutic targets.
4. Development and application of live imaging methods for analyzing immune cell activation and trafficking.

【Research Goals】

1. Explain the mechanisms of the immune system and perform basic analyses using immunological, molecular and cell biological techniques.
2. Use or generate animal models of immune diseases to analyze and deepen our understanding of their causes, pathologies, and potential treatments.
3. Systematically understand the molecular basis of cellular transformation mechanisms, including cell differentiation and oncogenesis, and cultivate a research attitude that bridges fundamental life sciences and medical applications.
4. Acquire the skills to independently design and conduct research projects, interpret and discuss experimental results, and present findings through presentations and scientific papers.



Associate Professor
Satoshi Matsuda

## Research Field : Cell Signaling (Department : Bioinformatics)

【Research Fields】

Immunity is an important mechanism that protects from the threat of infection. However, excessive immune response sometimes causes suffering in the form of seasonal allergies. Many of the seasonal allergy medicines in use today are for controlling symptoms. However, if we could understand why some people have seasonal allergies while others do not, we may be able to find a new treatment for seasonal allergies that intervenes at the mechanistic level. Focusing on the MAPK and mTORC1 pathways, which are typical signal transduction pathways for cells to receive extracellular information, our laboratory aims to deepen our understanding of the mechanism by which the immune system works normally, and to develop artificial immune control methods using this mechanism. In addition, substances are constantly exchanged within the cell via vesicles, and abnormal vesicle transport has various effects on the cell response. We have very recently discovered that the Arf pathway, which controls vesicle transport, plays an important role in the immune system, thus we are also working on the development of new treatment methods for autoimmune diseases that target the Arf pathway.

【Research Goals】

1. To understand the signal transduction pathway involved in the activation of immune cells.
2. To understand the molecular mechanism of immune tolerance induction and its impairment.
3. To understand immunodeficiency and autoimmune pathology at the molecular level.
4. To publish research content at international conferences.



Associate Professor
Sung-Il Lee

## Research Field : Laboratory Animal Medicine (Department : Animal Models for Human Diseases)

**【Research Fields】**

Experimental animals have made significant contributions to medical research. The use of experimental animals will continue to be essential, and is expected to develop even further. However, it is necessary to make efforts to reduce the number of animals used in experiments, to find alternatives, and to minimize the pain experienced by animals when use is unavoidable; essentially, to follow the “three Rs” of animal research: reduction, refinement, and replacement. From the standpoint of animal protection, we are making efforts to improve the health, medicine, and welfare of the animals used in experiments. We conduct research using experimental animals, such as generating genetically modified animals or infected animals, as well as performing surgical treatment, to create disease model animals. In addition to such in vivo research, we actively conduct in vitro research using cell lines as an alternative to animal models. Through these, we are promoting research on the elucidation of life phenomena, the development and evaluation of antiviral drugs, treatment methods and drugs for immune and metabolic bone diseases, as well as the determination of the mechanisms of various diseases.

**【Research Goals】**

1. To gain knowledge of, and skills for, ethical scientific animal experiments.
2. To be able to understand and apply/implement welfare and disease management related to experimental animals.
3. To be able to set a research topic and generate genetically modified animals and disease model animals using developmental engineering technology.
4. To be able to analyze data by establishing a useful experimental system that makes use of the characteristics of model animals.
5. To be able to summarize research content as papers and appropriately disseminate it to society.



Research Institute Professor
Reiko Kobayakawa

## Research Field : Functional Neuroscience (Department : Functional Neuroscience Genetics)

**【Research Fields】**

Humans and animals have evolved latent life-protective abilities to survive in crises. However, it remains unclear what types of protective abilities exist, whether sensory stimuli can artificially induce them, and whether such induction methods can be used as medical technology. We found that activation of TRPA1 in the vagus and trigeminal nerves, and the olfactory receptors in the olfactory sensory neurons by thiazoline-related fear odors (tFOs) that satisfy specific chemical structural rules orchestrate various physiological responses. These physiological responses include hypometabolism, hypoxia resistance, and anti-inflammatory immunoenhancement, which increased survival in crises and lethal pathological models. We advocate the application of this phenomenon as “sensory medicine,” a technology that uses sensory stimuli to induce latent life-protective effects via the brain. TFOs directly bind to TRPA1 in the vagus and trigeminal nerves; their sensory information activates the central crisis pathway from Sp5/NTS in the brain stem to PBN in the midbrain, which orchestrates various physiological responses. In our research department, we are studying the mechanisms of how sensory receptors recognize odor information and transmit crisis information to the brain and how the brain evaluates crisis information and induces a systemic physiological response. Sensory medicine technology has been found to be able to treat pathological models of sepsis, ischemic heart disease, and cerebral infarction, which continue to cause the largest number of deaths in the world, and we are aiming for early commercialization of the technology as human therapeutic drugs.

**【Research Goals】**

1. To learn skills to formulate a research plan, carry out research independently, and publish the results as papers.
2. To understand molecular biology techniques and learn the skills to generate genetically modified model mice.
3. To learn the skills to examine genetically modified model mice using molecular biology, biochemistry, and physiology methods.



Research Institute Professor
Ko Kobayakawa

## Research Field : Sensory Medicine (Department : Human Stress Response Science)

【Research Fields】

1. Elucidation of the working principles of sensory medicine that induces artificial hibernation/life protective state
2. Clinical translation and implemetation of sensory medicine
3. Elucidation of the mechanistic principles governing network functions of sensory system, brain, and organs throughout the body
4. Research and development of innovative therapeutics for refratory diseases
5. Research and development of innovative technologies for modulating health and longevity

【Research Goals】

1. Acquire fundamental knowledge of sensory medicine and artificial hibernation/life-protective state.
2. Acquire the fundamentals of innovative drug discovery and medical technology development.
3. Conduct original research to elucidate the network functions of the sensory system, brain, and organs throughout the body.
4. Undertake research and development aimed at the clinical translation of sensory medicine and innovative medical technology.



Research Institute Professor
Koichiro Higasa

## Research Field : Genomic Medicine (Department : Genome Analysis)

【Research Fields】

Our department advances exploratory research on the genetic factors underlying the onset and prognosis of diverse diseases to drive the development of precision medicine—care informed by genomic data. Our research targets the entire human genome, which contains a huge amount of information, to elucidate disease mechanisms by applying statistical genetics and advanced bioinformatics, including state-of-the-art machine learning and high-performance parallel computing. In 2013, we launched the Human Genetic Variation Database (HGVD), the first database of genetic variation in the Japanese population. HGVD has enabled efficient identification of pathogenic variants in intractable diseases and cancer, accurate genotype imputation for genome-wide association studies, and improved prediction of adverse drug reactions. The dissemination of genomic information through HGVD continues to accelerate progress in precision medicine.

【Research Goals】

1. To develop theories and analytical methods in statistical genetics and bioinformatics.
2. To construct algorithms and pipelines for genome-scale analyses to identify disease-associated genetic factors.
3. To advance knowledge that enables genomic diagnosis and precision medicine.
4. To cultivate skills in research planning, execution, and scholarly communication.



Distinguished Associate Professor
appointed by the University President
Keizo Tokuhiro

## Research Field: Genome Engineering (Department: Genome Editing)

【Research Fields】

We research the molecular mechanisms of the early developmental process in fertilization in vivo. Studies on fertilization require the collection of eggs and sperms from living organisms, which is expensive and time-consuming, and many fertilization mechanisms remain unknown. In addition, although the methods for producing fertilizable ova from iPS cells in in vitro culture have been developed, the formation of motile sperm in in vitro culture has not succeeded, and these methods still pose high hurdles for the use in general research. In recent years, genome editing using the CRISPR/Cas9 system has allowed the generation of gene-deficient mice and in vivo functional analysis with ease, leading to rapid progress in the elucidation of molecular mechanisms. Our laboratory also aims to develop new genome editing technology, while utilizing existing technology to understand the details of the molecular mechanisms of fertilization in vivo. Furthermore, we will examine various biological phenomena and elucidate molecular mechanisms by inserting loss of function mutations and genes encoding fluorescent proteins into cultured cell lines with genome editing technology.

【Research Goals】

1. To understand research methods using genome editing technology and learn genomic editing skills in cultured cells or fertilized eggs.
2. To learn the techniques to analyze the molecular mechanisms of biological phenomena and diseases using genetically modified mice.
3. To learn the skills to formulate a research plan, carry out research independently, and publish the results as papers and at conferences.



Distinguished Professor appointed
by the University President
Takeharu Sakamoto

## Research Field: Cancer Biology (Department: Cancer Biology)

【Research Fields】

Cancers in human bodies are promoted by various factors (e.g. gene mutations, an accumulation of DNA damages etc.) and often gain malignancy by interacting with their surrounding factors generally called tumor microenvironments. The main focus of researches in our department is to elucidate the mechanisms of cancers gaining malignancy through interactions with tumor microenvironments and further identify the novel therapeutic targets/drugs. Based on our aims of research, we are currently working on the following projects related to following contents:

1. Elucidation of molecular mechanisms involved in cancer microenvironment and inflammation regulation.
2. Elucidation of drug resistance mechanisms in cancer.
3. Elucidation of mechanisms underlying cancer progression and metastasis through cancer-stroma interaction.
4. Drug discovery research targeting novel cancer microenvironment-regulating molecules.

【Research Goals】

1. To attain proficiency in molecular biological techniques involving DNA, RNA, and proteins.
2. To be trained in cell biological techniques such as culture of human and mouse cells.
3. To develop the skills required to analyze carcinogenesis, tumor growth, and metastasis using genetically modified mice.
4. To be knowledgeable in techniques for analyzing information in public databases such as expression and mutation of cancer genes.
5. To acquire the skills to plan and conduct research independently, logically explain the validity of the results, and present the results in papers and academic conferences.



Research Institute Professor
Hirofumi Hanaoka

## Research Field : Photoimmunotherapy (Department : Fundamental Technology Development)

【Research Fields】
Photoimmunotherapy is a treatment that selectively kills the cancer cells to which the drug is bound. An antibody-IR700, a photoactivating chemical, conjugate is used as a drug for photoimmunotherapy. After the drug has accumulated in the cancer, near-infrared light is exposed to the entire cancer tissue. The therapeutic mechanism of photoimmunotherapy is that the photoinduced chemical change of IR700 causes the cell membrane damage, and water flows into the cell, which eventually leads to rupture of the cell. Thus, normal cells are not injured even if the drug is present nearby, which is the reason for its selectivity for cancers. Currently, only photoimmunotherapy targeting EGFR is in clinical use, but with the development of drugs for new target molecules, photoimmunotherapy can be applied to wide variety of cancers. So, our research aim is to develop a novel photoimmunotherapy drug and we promote the following research.

1. Exploring a novel target for photoimmunotherapy.

2. Design and production of novel photoimmunotherapy drugs.

3. Basic evaluation of photoimmunotherapy drugs in vitro and in vivo.

【Research Goals】
To learn basic techniques rerated to photoimmunotherapy research.
To learn how to plan and conduct research.
To be able to present research results appropriately.



Research Institute Professor
Hidehiro Fukuyama

## Research Field : Vaccine Immunology (Department : Immunology)

【Research Fields】
The antibodies play a crucial role in recognizing and eliminating pathogens from the body. With around one trillion repertoires of antibodies, considering that the human genome has around 20,000 genes, the diversity of antibodies is a remarkable number. In recent years, leveraging this diversity, antibody therapeutic drugs and diagnostic medications for diseases such as cancer and Alzheimer's have been developed.

The discovery of "human" antibodies is a novel area of research. Isolating antibodies directly from humans offers two advantages: (1) immediate application to humans and (2) enhanced safety. For instance, human antibodies isolated from convalescent COVID-19 patients were rapidly applied for treatment in humans. The process of isolating effective antibodies from human samples, however, presents experimental design challenges. We are committed to developing a high-throughput screening method to obtain human antibodies against various types of tumors, which will be applied to antibody-drug conjugate-based cancer therapies, including photoimmunotherapy.

In addition, we are actively engaged in developing a new-generation vaccine system by identifying novel adjuvants and introducing a needleless vaccine system. This approach aims to provide easy and safe access to medical welfare, especially in situations where there is a shortage of human resources. The following link provides examples of the outcomes and directions of our research:
https://www.youtube.com/watch?v=iYk6nZoKau8
https://www.youtube.com/watch?v=K68azXjhgp8

【Research projects】
- Human antibody discovery for cancers
- Revealing mechanism of Immune memory reaction
- Designing synthetic vaccine antigen inducing highly specific and effective conformation-specific antibody
- Finding novel adjuvants
- Developing needless vaccine system
- Elucidating mechanism of immune tolerance for vaccine design
- Unveiling the immune regulatory mechanisms via peripheral nervous system



Distinguished Professor appointed by the University President
Eisaku Kondo

## Research Field: Molecular tumor pathology and medicine (Department: Tumor Pathology)

【Research Fields】

Our department specializes in tumor pathology, and the basic pathology promotes research to elucidate the key molecular mechanisms of growth, invasion and metastasis of malignant tumors, especially focusing on intractable cancers, for clinical diagnosis and application. Elucidating the mechanisms of tumor resistance against advanced drugs is also an important issue, we have created a practical pathological research system that integrates molecular and histopathological analyses. Our goal is to find important clues for overcoming cancer that can be applied to clinical practice. With the aim of applying the research to cancer therapeutics, we are also paying an effort to develop an innovative medical technology such as novel peptides and antibodies to target cancer for next generation tumor medicine. We believe this research is quite unique in pathological department. Our department aims advanced and comprehensive molecular tumor pathology through crosstalk with the forefront of cancer medicine in the 21st century.

Followings are the subject in our research;

1. Exploring the novel tumor markers and key regulators to elucidate molecular mechanism of growth and invasion/metastasis for cancer diagnostics and therapy.
2. Developing the cancer-targeting agents of novel modality, especially focusing to the novel DDS-based anti-tumor drug targeting intractable/advanced stage cancer.

【Research Goals】

1. To learn basic skills including histopathological and molecular analyses of tumor cells and tissues.
2. To learn in vitro cell culturing and prepare in vivo tumor models using mice for experiments.
3. To know how to interpret the experimental result and work out the strategy by themselves for next step in their own research.



Professor
Tomoki Ito

## Research Field: Hematology, Respiratory Medicine, Rheumatology and Infectious Disease Medicine (Department: Internal Medicine I)

【Research Fields】

The Department of Internal Medicine I manages tumors, infectious diseases, and immune diseases, all of which involve biological defense/immunity pathology. Thus, a research theme essential for understanding and treating these diseases is “immunology.” Currently, it seems that treatment strategies using external factors, such as anticancer drugs and antibiotics, are reaching their limits. Therefore, we believe that it is important not only to view immunology as a basic discipline but also to link it to clinical diseases in the future, leading to the establishment of new treatment strategies. The research theme of our department is to conduct clinical and basic research using human dendritic cells that control the immune system. As a specific goal in the near future, we plan to develop new drugs discovery and diagnostic methods targeting dendritic cells.

【Research Goals】

1. To understand the functions of major immune cells, such as dendritic cells, T cells, and B cells, in the immune system for biological defense.
2. To understand the concepts of innate immunity and acquired immunity, as well as their differences.
3. To understand transplant-related immunity (such as GVHD).
4. To learn the basic techniques of in vitro experiments using human cells and in vivo experiments using mouse models.
5. To perform statistical analysis based on experimental data.
6. To present research content.

## Research Field : Cardiology, Nephrology, and Endocrinology and Metabolism (Department : Internal Medicine Ⅱ)

This section will be updated soon.



Clinical Professor
Masahiko Takagi

## Research Field : Clinical Arrhythmia (Department : Internal Medicine Ⅱ)

**【Research Fields】**

We research the latest non-invasive methods, such as a site-specific Holter signal-averaged electrocardiography, for detecting electro-cardiac abnormalities like J wave and Brugada syndromes, which are causative diseases of sudden death in young people. We also study the therapeutic effects of non-drug treatments (catheter ablation and implantable cardioverter-defibrillator) on refractory ventricular arrhythmia. Our clinical research on catheter ablation focuses on the identification of substrates of arrhythmia using a high-resolution three-dimensional mapping system (Rhythmia System ™ [Boston Scientific, Massachusetts, USA], Ensite System ™ [Abbott Medical Japan, Tokyo, Japan]) and prevention of recurrence by the substrate ablation, while our clinical research on implantable cardioverter-defibrillator focuses on methods to reduce inappropriate therapy and avoiding shock treatment. These studies aim to develop treatment methods that improve the prognosis of patients. Furthermore, we are also actively introducing a remote monitoring system for patients with cardiac implantable devices, which receives remote transmission data regularly to detect and intervene in arrhythmic events and device malfunctions at an early stage, and we study the effects of early intervention on the improvement of life prognosis.

**【Research Goals】**

1. To understand treatment methods for arrhythmia and learn basic techniques.
2. To set a research topic and understand the necessary theory and matters that have been revealed previously.
3. To collect and analyze data accurately.
4. To present research content appropriately.
5. To publish research results at domestic and overseas conferences.
6. To summarize research results and publish them as scientific papers.



Professor
Makoto Naganuma

## Research Field: Gastroenterology and Hepatology (Department: Internal Medicine Ⅲ)

【Research Fields】

**Research on the gastrointestinal tract**

Using clinical specimens after endoscopic resection for esophageal cancer, gastric cancer, and colorectal cancer, we aim to elucidate the etiologic role of transforming growth factor (TGF) β signal transduction mechanisms, as well as research the mechanisms of carcinogenesis, progression, and metastasis. In addition, our study on the involvement of regulatory T cells in colorectal cancer metastasis using extracellular vesicles was selected as the Best Abstract Award of the United European Gastroenterology in 2021. Furthermore, , nationwide clinical research with multicenter study was conducted as a principal investigator to create clinical evidence directly linked to medical care at the Japan Agency for Medical Research and Development.

**Research on the liver**

We perform basic research on the mechanisms of hepatic fibrosis and hepatocarcinogenesis, focusing on TGF-β signal transduction, aiming for clinical application. In addition, with the current need for digitization in medical care, we are also conducting research on application development based on AI technology for alcoholic liver disease and non-alcoholic steatohepatitis.

**Research on the pancreas and bile duct**

In addition to contributing to the revision of diagnostic criteria and clinical practice guidelines for acute pancreatitis, chronic pancreatitis, and autoimmune pancreatitis, we research the involvement of intestinal flora in pathophysiology. In addition, as clinical research unique to our department, we have reported a surveillance method aimed at early detection of pancreatic cancer and a photodynamic pancreatic cancer screening method using 5-aminolevulinic acid.

【Research Goals】

1. To make an experimental plan based on a research theme.
2. To learn the experimental methodology necessary for the experimental plan.
3. To analyze and interpret obtained data by presenting it.
4. To summarize and submit data as papers and present it at major domestic and overseas conferences, disseminating results and receiving evaluations.
5. To experience and understand medical research through a series of studies.



Professor
Takayasu Kurata

## Research Field: Thoracic Oncology (Department: Thoracic Onoclogy)

【Research Fields】

The Department of Thoracic Oncology provides medical care, focusing on chemotherapy and palliative care for patients with malignant tumors of the chest (mainly lung cancer). Chemotherapy for lung cancer has made significant progress in recent years due to the development of molecular-targeted drugs based on actionable genetic abnormalities in tumor tissues and immune checkpoint inhibitors. However, studies on resistance mechanisms in molecular-targeted drug therapy, as well as studies on effect prediction factors and resistance biomarkers for immune checkpoint inhibitors, are considered to be unmet needs, and our department aims to promote the research on these topics. In addition, while advancing the use of these drugs in precision medical care, we aim to actively promote pharmacokinetic research to examine the characteristics of each drug.

【Research Goals】

1. To understand the characteristics, treatment concepts, and prognosis of malignant tumors.
2. To understand the concept of clinical trials.
3. To learn basic knowledge and techniques necessary for basic cancer research.
4. To set a research topic and understand the necessary theory and previous data.
5. To perform statistical analysis based on experimental and clinical trial data.
6. To present research content appropriately.



Professor
Hideaki Hasuo

## Research Field: Psychosomatic Medicine (Department: Psychosomatic Medicine)

**【Research Fields】**

With current changes in social and medical paradigms, disease structures have begun to change in recent years. In a growing number of diseases, general medical examinations of persistent physical symptoms reveal no corresponding abnormalities, for which medical approaches tend to be less effective, and we have also begun to find psychosocial factors involved in an increasing number of cases. Among those, functional somatic syndrome, a collective term for functional diseases including irritable bowel syndrome, functional dyspepsia, and fibromyalgia, has been reported to have common pathological conditions, and the elucidation of their pathophysiology, as well as the examination of countermeasures, is needed due to their clinical significance. In our department, we mainly examine psychosomatic and functional pathological conditions of functional somatic syndromes and chronic pain syndromes, as well as their countermeasures, from various angles. Recently, we also examine the psychosomatic conditions of physical symptoms in patients with cancer and their family caregivers, and the interaction between them.

Focusing on “psychosomatic correlation,” which is the main theme of psychosomatic medicine, we aim to examine complex and diverse pathological conditions by understanding how factors at various levels, from basic physiology to interpersonal systems, are involved in pathological conditions. Although measurements of physiological functions are often used in such studies, they require dynamic measurements, such as fluctuation due to stress load and 24-hour continuous measurements in normal daily life, rather than conventional static measurements. In addition, we use multivariate statistical analyses, such as path analysis, to examine the relationships between multiple factors. Furthermore, qualitative research methods, including conversation analysis, are used to analyze the relationship between physicians and patients. We conduct clinical research in psychosomatic medicine by making full use of a variety of these methods.

**【Research Goals】**

1. To understand the effects of psychological aspects on physical conditions, and conversely, the effects of physical aspects on psychological conditions.
2. To understand the formation of pathological conditions through interaction and circulation.
3. To learn measurement methods of psychological aspects and measurement techniques of physical functions.
4. To set a research topic regarding the pathophysiology of psychosomatic correlation and understand the necessary theory and previous research results.
5. To perform statistical analysis of psychological and physical multivariate data by selecting appropriate methods.
6. To present research content appropriately.



Professor
Yusuke Yakushiji

## Research Field: Neurology (Department: Neurology)

**【Research Fields】**

**What is cerebral small vessel disease (SVD)?**

Cerebral small vessel disease (SVD) is a general term for conditions that result from damage to the small vessels within the brain. The underlying cause is subtle vascular changes that are difficult to detect with standard imaging techniques. This microvascular damage is known to be deeply involved in the onset of stroke, dementia, and even general aging processes. Our laboratory is engaged in the following advanced research projects to elucidate the multifaceted pathophysiology of SVD and explore its clinical significance.

a. SVD and stroke: We are studying risk factors for stroke onset and prognostic factors for poor outcomes after stroke, utilizing data from healthy and stroke cohort studies (Kashima Scan Study and HAGAKURE study). Furthermore, we are conducting brain imaging analysis using AI and researching its clinical applications.





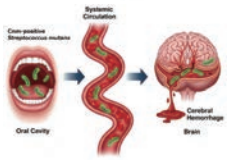




b. SVD and dementia: With the recent introduction of anti-amyloid antibody therapies for Alzheimer's disease, we have launched the HiRAPAR study, a prospective observational study for patients with mild cognitive impairment to early-stage dementia. Through this study, we are investigating the impact of SVD on the progression and characteristics of dementia.




c. “Oral-Brain Axis” via SVD: The “Oral-Brain Axis” is an emerging concept that recognizes the significant link between oral health and neurological conditions. It is increasingly understood that bacteria responsible for common issues like dental caries and periodontal disease are associated with neurological disorders. We aim to clarify the effects of specific bacteria on SVD and to develop new treatments for the prevention of stroke and dementia.



d. Iatrogenic cerebral amyloid angiopathy (CAA) as a type of SVD: CAA, characterized by the deposition of amyloid in cerebral vessels, is a major form of SVD. While CAA is common in the elderly, a newly proposed subtype, iatrogenic CAA (iCAA), has been identified. This condition can develop decades after neurosurgical procedures, such as craniotomies or dura mater grafts, performed in childhood. We aim to evaluate the prevalence of iCAA patients in Japan and to build a database that informs public health policy and serves as a foundation for future international collaborative studies.

**【Research Goals】**

1. To be able to understand the molecular pathology of cerebrovascular diseases.
2. To learn basic research techniques and methods necessary for elucidating the above pathological conditions.
3. To make a research plan to solve the research issue, carry out the research under the guidance, and report the results regularly.
4. To perform statistical analysis of research data by selecting appropriate methods.
5. To publish the results of the above goals as peer-reviewed papers.



Professor
Masaki Kato

## Research Field : Neuropsychiatry (Department : Neuropsychiatry)

【Research Fields】

The Department of Neuropsychiatry conducts research with an emphasis on answering clinical questions and needs, focusing on neurophysiology, clinical psychopharmacology, pharmacogenomics, and neuroimaging, aiming to optimize “precision medicine” for each patient. The therapeutic effects of antidepressants and antipsychotics vary depending on the patient, which has been a heavy burden on patients. In the search for predictors of treatment response, we have found genes predictive of clinical response through meta-analysis and analysis of monoamine-related genes and neuroplasticity-related genes. These results have been published in a number of psychiatric journals. By combining those genes with various biomarkers(miRNA, methylation, proteins, qEEG; quantitative electroencephalogram) and neurocognitive tests, we are aiming to build and clinically utilize technology to predict in advance the best treatment, like drugs, neuromodulation, or psychotherapy, for each patient. Based on our continuous research and sampling, our department has a lot of valuable data, which is one of the best in Japan. Our main overseas joint research facilities include the University of Bern (Switzerland), the University of Bologna (Italy), Karolinska Institute (Sweden), Harvard University, Stanford University (USA), and the University of Munich (Germany), allowing students to study abroad at highly specialized universities.

【Research Goals】

1. To clarify clinical questions and appropriately extract the elements necessary for their resolution while examining previous studies.
2. To learn the techniques to formulate, execute, and present a research plan to resolve clinical questions.



Professor
Kazunari Kaneko

## Research Field : Pediatrics (Department : Pediatrics)

【Research Fields】

With the advancement in gene analysis technology using next generation sequencing, knowledge on the human intestinal flora has accumulated, and its association with overall health is garnering attention. The intestinal flora plays an important role in human health, including nutrient metabolism and synthesis, infection protection against pathogens, and immune regulation. Therefore, it has become clear that various diseases are triggered by the disorder of the constituent bacterial species of the intestinal flora (dysbiosis). In young children, dysbiosis of the intestinal flora has been suggested to be associated with neonatal necrotizing enterocolitis, allergies, autism, obesity, diabetes, autoimmune diseases, and even sudden infant death syndrome. Thus, our laboratory in the Department of Pediatrics of Kansai Medical University is studying gut dysbiosis in various diseases of young children using next generation sequencing. Our research findings to date suggest that gut dysbiosis is one of the susceptibility factors in Kawasaki disease. Furthermore, we have demonstrated that the proportion of butyric acid-producing bacteria is reduced in children with recurrent idiopathic nephrotic syndrome and egg allergy.

【Research Goals】

1. To explore the causal link between gut dysbiosis and various chronic diseases in children.
2. To determine whether the prevention and treatment of various pediatric diseases can be achieved by restoring gut dysbiosis using probiotics and prebiotics.



Professor
Makoto Yamasaki

## Research Field: Upper Gastrointestinal Surgery (Department: Upper Gastrointestinal Surgery)

**【Research Fields】**

1. Development of novel supportive therapies to improve Health-related Quality of Life (HRQOL) in patients with esophageal cancer.
2. Development of a predictive model for sensitivity to immune checkpoint inhibitors using patient-derived tumor organoids.
3. Establishment of a novel diagnostic model for locally advanced esophageal cancer using MRI.
4. Research on the assessment of cancer related cognitive impairment during chemotherapy using mixed reality (MR).
5. Development of a novel ctDNA-based treatment selection method for gastrointestinal stromal tumors (GIST).
6. Development of a novel VR-based training system for young surgeons.

**【Research Goals】**

1. To be able to formulate a research question and design a research plan to elucidate unresolved scientific problems.
2. To master the proper handling and preservation methods for human clinical specimens.
3. To master fundamental molecular biology techniques for analyzing human and animal samples, including cell culture, PCR, Western blotting, ELISA, flow cytometry (FCM), tissue slide preparation, and microscopy-based analysis.
4. To be able to carry out research collaboratively as a member of research team.
5. To be able to present research findings and report them in scientific papers.



Professor
Jun Watanabe

## Research Field: Oncologic Surgery for Colorectal Diseases (Department: Colorectal Surgery)

**【Research Fields】**

1. Establishment of multidisciplinary treatment and precision medicine for colorectal cancer.
2. Development of surgical techniques to enhance the precision of lymph node dissection.
3. Development of surgical procedures to reduce postoperative complications.
4. Elucidation of the relationship between tumor budding at the invasive front and tumor-stromal interactions, as well as the patterns of invasion and metastasis.
5. Development of an AI software for analyzing surgical videos to automatically identify critical intraoperative structures, recognize surgical phases, and predict the operation's completion time.

**【Research Goals】**

1. To understand the pathophysiology of diseases in lower gastrointestinal and oncologic surgery.
2. To understand recent advances and future perspectives in lower gastrointestinal and oncologic surgery.
3. To be able to formulate a research question and understand the necessary theories and existing evidence.
4. To be able to perform statistical analysis based on experimental data.
5. To be able to present research findings effectively.

## Research Field : Colorectal Pathophysiological Surgery (Department : Colorectal Surgery)

This section will be updated soon.



Professor
Masaki Kaibori

## Research Field : Liver Surgery (Department : Hepatobiliary Surgery)

**【Research Fields】**

In the Liver Surgery Department, we conduct research to establish safe and effective laparoscopic hepatectomy for hepatocellular carcinoma and to reduce perioperative risk in elderly patients, as well as clinical research on the therapeutic effects of immune checkpoint inhibitors. Our multi-institutional joint research with domestic and overseas facilities includes the development of effective treatment methods for hepatobiliary diseases, large-scale studies based on the analysis of big data such as NCD (National clinical database), and the elucidation of carcinogenic factors based on comprehensive genetic analysis of hepatocellular carcinoma and bile duct cancer. In addition, our specific clinical research investigates the effects of hydrogen on the postoperative recovery of patients after hepatectomy. In addition to developing a new DDS (Drug delivery system) using nanofiber mesh and a postoperative adhesion prevention material, we conduct a wide range of research. Our research includes the immunohistochemical analysis of immune checkpoints in hepatobiliary pancreatic cancer using fluorescent nanoparticles. We also analyze the hepatoprotective effects of Chinese herbs and foods in suppressing inducible nitric oxide synthase (iNOS), which is hepatotoxic. We examine the effects of mesenchymal bone marrow cells on post-hepatectomy and transplanted livers on liver regeneration, aiming to prevent liver failure after liver surgery. Our clinical research on liver regeneration therapy uses stem cells to save the lives of patients with end-stage liver failure, and we analyze the relationship between transforming growth factor-β signal transduction and prognosis in liver cancer.

**【Research Goals】**

1. To understand the pathophysiology of diseases related to abdominal surgery, focusing on the liver area.
2. To understand recent advances in surgery and new research prospects.
3. To set a research topic and understand the necessary theory and previous evidence.
4. To perform statistical analysis based on experimental data.
5. To present research content appropriately.
6. To write papers on research results.
7. To obtain research funds based on research results and promote research further.



Professor
Sohei Satoi

## Research Field: Pancreatobiliary Surgery (Department: Pancreatobiliary Surgery)

【Research Fields】

**Basic research**

1. Comprehensive analysis of the microbiome in pancreatic cancer.
2. Analysis of biomarkers that predict responses to therapies for peritoneal disseminated pancreatic cancer.
3. Determining expression profiles of adipophilin in biliary pancreatic cancer and clinical pathological examinations.
4. Research on the presence of cancer-related fibroblasts, cancer stem cells, and prognoses in biliary pancreatic cancer.
5. Research on the expression of Caspase 3 (immunostaining) and the assessment of therapeutic effects of preoperative treatments in pancreatic cancer.
6. New pathological assessment tool of pathological tumor shrinkage patterns after preoperative chemotherapy/radiotherapy and prognosis in pancreatic cancer.
7. Examination of the association between the proportion of acinar cells in pancreatic segments and postoperative pancreatic fistula.
8. Pathological and genetic analysis of ascites via cyto-diagnoses during pancreatic cancer surgery.
9. In vitro/in vivo study of photoimmunotherapy for clinical application in patients with pancreatic cancer.

**Clinical research (representative/specific research)**

10. A multicenter, phase III randomized controlled trial to examine the usefulness of intravenous/intraperitoneal combination.
11. Administration of S-1+paclitaxel for patients with peritoneal metastasis of pancreatic cancer (advanced medical care).
12. A multicenter, double-blind, phase II randomized controlled trial to examine the improvement in treatment outcomes for pancreatic cancer due to the administration of AHCC (functional food).
13. A multicenter phase II randomized controlled trial to examine the improvement in treatment outcomes for unresectable pancreatic cancer due to the administration of AHCC (functional food).
14. Intraoperative pancreatoscopy in IPMN patients (international multicenter joint research).
15. Clinical efficacy of chemotherapy switch in patients with resectable/borderline resectable pancreatic cancer.
16. Standardization of perioperative management of pancreatic surgery.

【Research Goals】

1. Develop the ability to set a clear research agenda and design a research plan to address unresolved issues.
2. Acquire and appropriately apply immunogenetic approaches using clinical specimens.
3. Construct a research database (including data cleaning) and perform appropriate statistical analyses.
4. Conduct research effectively as a member of a clinical research team.
5. Present research findings effectively at both domestic and international conferences.
6. Summarize and write up research results in English.



Professor
Takashi Doi

## Research Field: Pediatric Surgery (Department: Pediatric Surgery)

【Research Fields】

There are many unexplained congenital diseases in pediatric surgery whose mechanisms have not been elucidated. To investigate their causes, it is important to study embryology and fetal development. We conduct basic research that aims to understand the etiology of typical congenital diseases by using established animal disease models. Specifically, the animal models used in our research include: ① the Hirschsprung's disease mouse model, ② the congenital diaphragmatic hernia rat model, and ③ the umbilical hernia avian model. By using techniques such as immunostaining and RT-PCR, we perform molecular analysis of responsible genes and proteins that can cause each disease, and aim to understand congenital disease etiology in order to understand potential prevention methods. Furthermore, because some of the congenital diseases studied in our research involve defective organs, we also research regenerative medicine. Specifically, as joint research with the Department of Stem Cell Regenerative Medicine, we work to create striated muscle sheets using iPS cells. Lastly, we have initiated a basic pilot study that aims for the clinical application of an artificial biological patch for congenital diaphragmatic hernia, which has a low survival rate.

【Research Goals】

1. To understand the pathophysiology of pediatric diseases and surgical treatments.
2. To write papers in English.
3. To present at conferences in English.



Professor
Masahiro Takada

## Research Field: Breast Surgery (Department: Breast Surgery)

**【Research Fields】**

1. Elucidation of the carcinogenic mechanisms of hereditary breast cancer.
2. Development of novel biomarkers to predict prognosis and treatment response in breast cancer.
3. Development of mathematical models to predict the pathophysiology and treatment response of breast cancer.
4. Clinical research on developing novel therapies and improving Quality of Life (QOL) for breast cancer patients.

**【Research Goals】**

1. Understanding the pathophysiology of breast cancer.
2. Understanding the molecular mechanisms involved in the initiation, proliferation, and metastasis of breast cancer.
3. Formulating a research plan based on clinical questions.
4. Understanding data analysis methods.
5. Developing the ability to critically appraise and appropriately interpret analysis results.
6. Presenting research findings at major domestic and international academic conferences.
7. Summarizing and publishing research findings in peer-reviewed academic journals.



Professor
Tadaaki Koyama

## Research Field: Cardiovascular Surgery (Department: Cardiovascular Surgery)

**【Research Fields】**

Genetic Analysis of Cardiovascular Diseases with a Focus on Marfan Syndrome and Related Disorders

This research field explores the genetic basis of cardiovascular diseases, with a special emphasis on Marfan syndrome and related disorders. These are inherited disorders that affect the elastic fibers in various tissues, leading to cardiovascular complications such as aortic aneurysm and dissection. We use genetic panel sequencing to detect mutations in the *FBN*1 gene that encodes fibrillin-1, a major component of elastic fibers, and to evaluate their pathogenicity and clinical significance. Some of the detected variants are of unknown significance (VUS), which require further investigation and validation. We also utilize genomic omics data to identify novel biomarkers and therapeutic targets for cardiovascular diseases. This research field provides an opportunity to acquire advanced skills and knowledge in genetic analysis and cardiovascular surgery, and to contribute to the development of precision medicine for cardiovascular diseases.

**【Research Goals】**

1. To identify and characterize the mutations in *FBN*1 and other genes involved in elastic fiber formation and function in patients with Marfan syndrome and related disorders

2. To develop and validate novel biomarkers and therapeutic strategies for cardiovascular diseases based on genomic omics data



Professor
Tomohiro Murakawa

## Research Field: Thoracic Surgery (Department: Thoracic Surgery)

【Research Fields】
We study the relationship between the expression of PD-L1 (programmed cell death ligand-1) and prognosis in lung cancer in collaboration with the Departments of Thoracic Oncology and Pathology. Aiming to clarify the relationship of PD-L1 expression in tumor tissues with prognosis, and the effects of anti-PD-1 antibody treatment, we retrospectively examine the clinicopathological correlations based on the comparison of PD-L1 expression with prognosis and treatment information. Furthermore, aiming to find biomarkers associated with pre-metastatic niches in lung cancer, we work to identify factors associated with pre-metastatic niches, risk factors for postoperative recurrence and metastasis, and cells responsible for pre-metastatic niche-related symptomatic signals in lung cancer, through a comprehensive analysis of inflammatory signals in pre-metastatic niches in lung cancer. We are also developing a new diagnostic method for pneumothorax, which is the second most common disease in the field of thoracic surgery after lung cancer.

【Research Goals】
1. To understand the pathophysiology and pathology of diseases related to thoracic surgery, focusing on the lung, mediastinum, and pleura.
2. To understand the latest advances and new research prospects in thoracic surgery.
3. To set a research topic and understand the necessary theory and published data
4. To perform appropriate statistical analysis, such as survival analysis, based on research data.
5. To present research results appropriately.



Professor
Masahiro Nonaka

## Research Field: Research and Therapy of Brain Tumors and Central Nervous System Diseases (Department: Neurosurgery)

【Research Fields】
1. Development of diagnostic and therapeutic methods for brain tumors.
2. Elucidation of the pathophysiology of central nervous system (CNS) malformations.

【Research Goals】
1. Understand the pathophysiology and pathogenesis of neurosurgical diseases.
2. Understand the treatment methods for neurosurgical diseases.
3. Understand the pathophysiology and pathogenesis of malignant brain tumors.
4. Understand the principles of anti-tumor immunity.
5. Understand genome analysis and genome editing.
6. Acquire basic laboratory techniques, including cell culture, flow cytometry, immunohistochemistry, and animal experimentation.
7. Develop the ability to identify unresolved research questions through conference participation and literature review.
8. Develop the ability to design appropriate experimental methods to address research questions.
9. Acquire statistical knowledge for the analysis and validation of experimental data.
10. Develop effective presentation skills to communicate research findings.
11. Develop the ability to write scientific manuscripts based on research findings.

## Research Field: Orthopedic Surgery (Department: Orthopedic Surgery)

This section will be updated soon.



Professor
Kimitaka Hase

## Research Field: Physical Medicine and Rehabilitation (Department: Physical Medicine and Rehabilitation)

**【Research Fields】**

Based on motor learning theory and clinical data mining, we aim to optimize rehabilitation therapy for the reconstruction of human activities. Treatment strategies in our studies include the use of rehabilitation robots, cognitive function training using mixed reality technology, and motor learning that comprehensively processes sensory noise (differential training). We quantify the effects of sensory-motor integration induced by these therapeutic tasks and determine the factors involved in the changes through the use of machine learning. By visualizing the performance formed by the interference of complex subsystems contained in individuals, tasks, and environments, we clarify problematic constraints and optimize the process of treatment policy decision-making. The treatment task that is developed by applying dynamic systems theory and utilizing clinical data mining supports the development of rehabilitation medicine that embodies "personalized medicine," departing from a "one size fits all solution." Such results will positively impact the global medical community, contributing to a care system that prevents the need for long-term care and extends healthy life expectancy.




**【Research Goals】**

1. To understand therapeutic strategies for the improvement of activities.
2. To understand the concept of motor learning in disability medicine.
3. To learn basic techniques for functional evaluation and rehabilitation treatment.
4. To set a research topic and understand the necessary theory and published data.
5. To be able to perform statistical analysis based on experimental data.
6. To be able to present research content appropriately.



Professor
Natsuko Kakudo

## Research Field: Plastic and Reconstructive Surgery (Department: Plastic and Reconstructive Surgery)

【Research Fields】

1) Adipose-derived Stem Cells (ASCs) are obtained from subcutaneous fat, and their effectiveness as regenerative medicine in the field of plastic surgery has become clear. We perform molecular biology analyses of cultured ASCs in our basic research, while our clinical research applies them to breast reconstruction after the resection of breast cancer.

2) Autologous platelet-rich plasma (PRP), which is produced by the centrifugation of collected blood, contains platelets in abundance. Because a large amount of various growth factors derived from autologous platelets is contained in PRP, we aim to apply PRP to wound treatment in decubitus and intractable ulcers.

3) Elucidation of the mechanism of keloid development and the development of its treatment methods. We analyze cells isolated from keloid tissues and examine the effects of tension on cells.

4) Tissues can be maintained in a below-freezing electric field environment, which lowers cellular metabolism and prevents cellular deterioration due to thawing. We study organ preservation using a below-freezing electric field environment.

1) and 2) have been approved for clinical use under the Act on the Safety of Regenerative Medicine, and we are developing clinical application at our university hospital.

【Research Goals】

1. To be able to understand the structures and functions of the skin, soft tissues, nerves, blood vessels, bones, and cartilage.
2. To understand the concepts of functions, forms, and color tones that make up and support the surface of the human body.
3. To be able to formulate a meaningful research theme related to clinical treatments in plastic surgery and develop a concrete experimental plan.
4. To learn basic techniques of processing methods for the collection and analysis of biological tissues.
5. To be able to find important events and previous reports related to the research theme and use them as a basis for research direction.
6. To present research content and results appropriately.



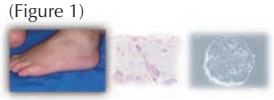
Professor
Hideaki Tanizaki

## Research Field: Dermatology (Department: Dermatology)

【Research Fields】

Examination of the mechanism of granuloma development using iPS cells derived from patients with the rare disease Blau syndrome (Figure 1)

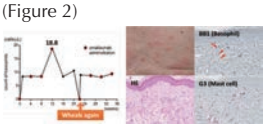
(Figure 1)



We are analyzing the mechanism of neutrophil-mediated acute inflammation and delayed inflammation typified by granuloma formation by establishing iPS cells from patients with Blau syndrome and inducing their differentiation into monocyte lineages.

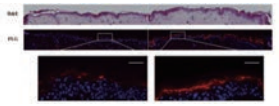
Examination of the migration of activated basophils from peripheral blood to skin (Figure 2)

(Figure 2)



We would like to find new insights of pathophysiology of urticaria from the viewpoint that in idiopathic urticaria, basophils infiltrate the skin lesion from the peripheral blood and are involved in the formation of wheals.

(Figure 3)



Analysis of natural moisturizing factors in the stratum corneum with and without the use of topical moisturizers in atopic dermatitis (Figure 3)

Focusing on natural moisturizing factors that play a central role in the barrier function and water retention of the skin, we aim to identify the cause of barrier dysfunction in diseases through functional analysis of moisturizing factors and percutaneous water evaporation and pH.

(Figure 4)



Examination of the risk of developing cardiovascular events associated with chronic skin inflammatory diseases (Figure 4)

We work to elucidate the pathophysiology of general complications associated with chronic skin inflammation, centering on psoriasis vulgaris. Focusing particularly on lifestyle-related diseases and vascular lesions, we also analyze the effects of the administration of biological products using donated cadavers.

【Research Goals】

1. To understand the structure and function of the skin.
2. To understand the pathophysiology of the diseases studied in our research and related diseases.
3. To learn basic techniques related to a research topic.
4. To perform statistical analysis based on experimental data.
5. To present research content appropriately and write papers.
6. To provide dermatological medical care through research and study.



Professor
Hidefumi Kinoshita

## Research Field: Urology and Andrology (Department: Urology and Andrology)

【Research Fields】

Our laboratory's main research theme is developing surgical education based on scientific analyses of surgery. For example, we have measured and analyzed the force applied to the tip of forceps used in laparoscopic surgery.

In laparoscopic surgery, surgeons cannot easily feel the force applied to the forceps tip, which may cause unexpected organ damage during the surgical dissection procedure. Although skilled surgeons can easily perform dissection based on experience, it is not easy for junior surgeons, and it is difficult to verbally instruct junior surgeons how to perform the procedure.

We hypothesized that showing the direction and magnitude of the acting force objectively would have a high educational effect, allowing junior surgeons to better understand the procedure. In our laboratory, we created a system that can measure acting force (vertical and horizontal forces) during dissection procedures, and analyzed the force applied to the forceps tip by surgeons of different skill-levels during dissection. The results indicated that skilled surgeons first apply a vertical force with a weak horizontal force, and then increase the horizontal force while reducing the vertical force. On the other hand, junior surgeons apply horizontal and vertical forces at the same time as they increase the forces from the start to end of the dissection.

The importance of such a method of scientifically analyzing surgeries is expected to increase in terms of understanding surgical principles, building the foundation of surgical education, and flattening the learning curve for technical acquisition.

【Research Goals】

1. To classify and outline diseases that occur in the adrenal glands, kidneys, and urogenital system.
2. To outline the onset and exacerbation of the diseases, as well as their molecular mechanisms.
3. To outline typical methods in life science research (such as genetic and cell biology experiments).
4. To give an outline of historical changes of major urological diseases, including their concepts, origins, and treatments.
5. To extract unsolved problems, formulate hypotheses, formulate research plans for solutions, and execute them.
6. To present research results at conferences, as well as to publish them as papers.
7. To outline of research ethics.



Professor
Hisanori Imai

## Research Field: Ophthalmology and Visual Science (Department: Ophthalmology)

【Research Fields】

1. Analysis of the pathogenic mechanisms of diabetic retinopathy and the mechanisms of retinal damage in macular edema using animal models.
2. Development of novel therapies for diabetic retinopathy and macular edema.
3. Basic analysis of retinochoroidal vascular imaging in diabetic retinopathy.

【Research Goals】

1. Understand the structure and function of the visual system.
2. Understand the concept of diabetic retinopathy.
3. Acquire basic techniques for creating animal models of diabetic retinopathy and for cell culture.
4. Define a research question and understand the relevant theories and previous findings.
5. Be able to perform statistical analysis based on experimental data.
6. Be able to present research content appropriately and effectively.



Professor
Masao Yagi

## Research Field : Otolaryngology, Head and Neck Surgery (Department : Otolaryngology, Head and Neck Surgery)

【Research Fields】

1. Establishment of preventive methods for age-related hearing loss (presbycusis).
2. Establishment of novel therapeutic strategies for thyroid tumors.
3. Analysis of the mechanisms of malignant transformation in human salivary gland tumors.
4. Analysis of the mechanisms of upper and lower airway inflammation using mouse models of allergic rhinitis and asthma.
5. Establishment of novel mouse models for diseases such as chronic rhinosinusitis and salivary gland cancer.
6. Investigation of the functional roles of eosinophils.
7. Application of exoscope systems and development of visual aids for surgery.
8. Elucidation of the therapeutic mechanisms of sublingual immunotherapy (SLIT).
9. Development of novel inhalation therapies for eosinophilic airway inflammation.
10. Elucidation of the mechanisms of oral allergy syndrome (OAS).

【Research Goals】

1. Understand the anatomical structures and functional roles in the fields of otology, the upper and lower airways (nose, paranasal sinuses, oral cavity, pharynx), and head and neck surgery.
2. Acquire skills in handling and analyzing human clinical samples, and understand the ethical principles of clinical research.
3. Master the proper handling of animals based on animal welfare principles, and learn to create and analyze mouse models of disease.
4. Acquire fundamental molecular biology techniques for analyzing human and animal samples, including PCR, western blotting, ELISA, flow cytometry (FCM), cell separation, tissue sample preparation, microscopy, and methods using nuclear medicine.
5. Be able to comprehend original English research articles to understand relevant theories and previous findings.
6. Establish the ability to objectively evaluate experimental data using statistical methods, effectively present research findings, and write scientific papers in English.
7. Develop an international perspective through international collaborations and presentations at international conferences.
8. Be able to conduct research collaboratively with researchers both within and outside the laboratory and university.
9. Be able to design and conduct research in compliance with ethical guidelines and regulations, including those for the disposal of hazardous materials.
10. Acquire proper methods for managing research samples and data, including documentation and storage procedures.



Professor
Noboru Tanigawa

## Research Field : Radiology (Department : Radiology)

【Research Fields】

**1. Diagnostic Imaging**

1. Based on image analyses of malignant tumors (stomach, prostate, rectal, and lung cancers) using multidetector computerized tomography (CT), 3-Tesla magnetic resonance imaging (MRI), and similar, we study the localization and depth diagnoses of tumors, their infiltration into surrounding tissues, degree of tumor differentiation, and correlation with prognoses, utilizing excised pathological specimen.

**2. Nuclear Medicine**

1. We investigate the usefulness of concurrent chemotherapy and Radio Isotope (RI) treatment targeting cancer, and aim to develop RI-labeled lipiodol for diagnostic imaging and therapeutics. In addition, we focus on a clinical understanding of pathological conditions, construction of efficient diagnostic methods, and aim to predict treatment effects by using RI for diseases such as Parkinson's disease (e.g. dopamine transporter imaging), head and neck tumors (F-18 FDG PET for predicting prognosis), lung cancer (prediction of the efficacy of immune checkpoint inhibitor therapy), prostate cancer (Ra-223 therapy), and malignant lymphoma (radioimmunotherapy).

**3. IR(Interventional Radiology)**

1. Using the animal imaging room, we study embolic agents, biological uses of nano-microbubbles, lymphatic IR, CT-guided IR, and the antithrombogenic and antibacterial device coating.

【Research Goals】

1. To understand the physical and biological properties of radiation.
2. To understand the concepts of radiodiagnosis and radiation therapy.
3. To learn fundamental techniques related to basic and animal experiments using radiation.
4. To set a research topic and understand the necessary theory and published data.
5. To perform statistical analysis based on data.
6. To present research content appropriately.

Research Field:Radiation Oncology
(Department:Radiology)



Clinical Professor
Satoaki Nakamura

## Research Field : Radiation Oncology (Department : Radiology)

【Research Fields】

In the Radiation Oncology Department, we provide curative treatment for a wide variety of malignant tumors and palliative treatment for cancer-related symptoms using the latest treatment equipment. Through these treatments, we also focus on the training of radiation oncologists and medical physicists.
The department also conducts a wide range of basic and clinical research rooted in the practice of radiation therapy as follows:

Clinical research: In the clinical practice of cancer radiotherapy, we are promoting clinical trials for head and neck cancer and pancreatic cancer using high-precision radiotherapy equipment, optimizing high-dose-rate interstitial radiotherapy for prostate cancer and gynecological cancer, and developing a system that can determine the indication for radiotherapy for bone metastases.

Medical Physics: We are conducting research on the development of radiotherapy using computer science, including the automation of image processing and radiotherapy planning using artificial intelligence, and the development of new analysis methods to comprehensively analyze image features obtained from medical images and to clarify the relationship between the features and clinical information.

In this way, we hope to provide state-of-the-art radiotherapy and at the same time create tomorrow's cancer treatment.

【Research Goals】

1. To understand the physical and biological properties of radiation oncology.
2. To understand the concepts of radiation therapy.
3. To set a research topic and understand the necessary theory and published data.
4. To perform statistical analysis based on data.
5. To present research content in English.

## Research Field : Imaging Diagnostics/Image Guided Therapy (Department : Radiology)

This section will be updated soon.



Professor
Hidetaka Okada

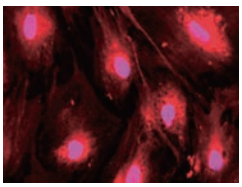
## Research Field: Obstetrics and Gynecology (Department: Obstetrics and Gynecology)

**【Research Fields】**

The Department of Obstetrics and Gynecology is the only clinical department involved in the birth of new life, supporting women and the future of Japan, and is a highly attractive area with multiple of research themes. Our department has established a new developing research style with close collaboration and cooperation in the fields of perinatal medicine, reproductive endocrinology, and gynecological oncology.

We analyze the functions of reproductive organs and cells and examine reproductive organ tumors by incorporating molecular biology techniques into immunohistochemical staining and cell culture. Particularly, in uterine research, which focuses on the central tissue of reproductive functions, we study the contraction mechanism of the uterine muscle to prevent miscarriage and premature birth, focusing on the effects of various drugs and external factors. In addition, our research on the functions of the endometrium, which is the key to the establishment of pregnancy, aims to develop better diagnostics and treatments of infertility (implantation failure) and recurrent miscarriages through molecular and genetic analysis of the mechanism of sex-hormone mediated cell differentiation.

Our clinical research focuses on developing a new method of lymph node dissection to reduce lymphedema, which is one of the complications. Furthermore, regarding new diagnoses and treatment methods for gynecological malignant tumors, we aim for practical application of navigation surgery for endometrial and ovarian cancers, as well as early minimally invasive treatment for cervical dysplasia.



We discovered seminal evidence that the transcription factor HAND2, involved in the functions of the endometrium, is strongly induced in the nucleus during the process of decidualization (differentiation) of cultured human endometrial stromal cells (pictured above).

**【Research Goals】**

1. To understand the structures and functions of the uterus and ovaries.
2. To learn basic techniques related to molecular and genetic analyses and tissue culture.
3. To set a research topic and understand the necessary theory and previously published data.
4. To be able to perform statistical analysis based on experimental data.
5. To be able to present research content appropriately.
6. To be able to publish research results as scientific papers.



Professor
Takahiko Kamibayashi

## Research Field: Anesthesiology and Critical Care Medicine (Department: Anesthesiology)

**【Research Fields】**

Platelets, in addition to their primary role in hemostasis and coagulation, are involved in the immune and inflammatory systems. Particularly, microparticles less than 1 μm in size released from platelets by platelet activation were first reported as “platelet dust” (platelet waste) in 1967, but recent studies have shown that these microparticles are important factors in the pathogenesis of inflammatory conditions through their interactions with other blood cells and vascular endothelial cells. Focusing on the effects of cardiopulmonary bypass during heart surgery, we promote clinical and basic research on the mechanism by which various perioperative stress reactions affect platelet function, blood coagulation and inflammatory response and their application to new therapeutic methods. Additionally, we are conducting basic research on organ protection in brain-death model animals and on hemodynamics using a myocardial-ischemia model. We also conduct clinical research on changes in brain waves at the sedation level, the development of sedation monitors, as well as outcome studies using medical statistics and medical big data. Furthermore, our joint translational research with the Department of Innovative Regenerative Medicine of the Graduate School at Kansai Medical University serves as a bridge between basic research and clinical practice.

**【Research Goals】**

1. To understand the pathophysiology of the invasive response of a living body.
2. To understand measures to control invasive immune responses.
3. To set a research topic to be carried out and understand the necessary theory and previously published data.
4. To carry out experiments and interpret their data by incorporating statistical analysis and other methods.
5. To present research content appropriately and discuss with trainers and other researchers based on evidence.
6. To learn and execute the process of compiling and publishing research results as papers.



Clinical Professor
Satoshi Hagihira

## Research Field: Anesthesia Pharmacology (Department: Anesthesiology)

【Research Fields】
Anesthetics cause loss of consciousness and memory, which reversibly recover after removal. Overly shallow anesthesia causes intraoperative awareness, while deep anesthesia causes delayed awareness and various perioperative complications. Therefore, maintaining an appropriate anesthetic concentration is highly important in clinical anesthesia. In addition, because current anesthetics do not have an analgesic effect, balanced anesthesia in combination with analgesics is commonly used. It is clinically important to understand how different combinations affect various effects of anesthesia due to the interaction between anesthetics and sedatives.

Thus, aiming to provide optimal anesthesia for each patient, we are investigating various methods, such as using pharmacokinetic knowledge and determining the effect of anesthesia based on brain waves. Also, to examine the effects of intravenous anesthetics in detail, we control the syringe pump with a computer to maintain the administration records of various anesthetics and sedatives, to perform pharmacokinetic simulations, and record brain wave data concurrently. Therefore, our research facilitates clinical practice.

【Research Goals】
1. To understand the pharmacokinetics of various anesthetics.
2. To understand how to read the waveform of brain waves of patients under anesthesia.
3. To understand the methodology of various brain wave analyses.

## Research Field: Acute Critical Medicine, Traumatology and Disaster Medicine (Department: Emergency and Critical Care Medicine)

This section will be updated soon.



Center Professor
Yuka Kojima

## Research Field: Dentistry and Oral Surgery (Department: Oral Care Center)

【Research Fields】
In our department, we are conducting research on medicaton, novel surgical methods and image diagnosis with the aim of elucidating the causes and pathology of patients suffering from Medication-related osteonecrosis of the jaw (MRONJ). We are also conducting research with the aim of establishing preventive and therapeutic methods for adverse events in the perioperative period. Through these studies, we provide education to help medical professionals who fully understand the function and anatomy of the oral cavity, who can formulate their own research plans, and who aim to establish treatment methods.

【Research Goals】
1. Thoroughly understand the functions and anatomy of the oral cavity areas.
2. To be able to practice perioperative oral care.
3. Understand the pathogenesis of medication-relation osteonecrosis of the jaws (MRONJ) and its treatment.
4. To be able to search past papers and understand what has been elucidated to date.
5. Learn how to handle human clinical samples.
6. Learn the basic techniques for analyzing samples.
7. To be able to perform statistical analysis and evaluate the data.
8. Learn how to properly manage and dispose of samples and manage data.
9. To be able to summarize research content, give appropriate presentations, and write English papers.
10. To be able to plan and carry out research based on laws and ethical regulations.
11. Acquire international sensibilities through presentations at international conferences.



Center Professor
Akira Kanda

## Research Field: Clinical Laboratory Medicine (Department: Clinical Laboratory Center)

【Research Fields】
The main research topics of our department are:

1.Development of new testing equipment
  1) New detection system using ultrasonic waves
  2) Novel comprehensive management system in the clinical laboratory by using flow line analysis with AI technology
  3) New immunological and biochemical tests system

2.Basic research
  1) Understanding of a mechanism of airway inflammation, especially “United airway disease”.
  2) New therapeutic strategy and targe compound upon airy inflammation
  2) Discovery of new biomarkers for allergic airway inflammation
  3) Clarify a functional role of eosinophils using original genetical modified mice
  4) Development of new compound upon olfactory dysfunction using original system

We support to master's and doctoral course students in order to obtain knowledge technology about measuring apparatus and physiological function testing, including quality control, testing procedure, and validity of examination. Students learn research ethics, acquire the knowledge necessary for research, collection technique, methods, analyze data, and writing technique of manuscript in our laboratory. Then, final goals are that students independently make experimental planning, perform experiments, and submission of paper by themselves; detail goals are described below.

【Research Goals】
1. Compliance with ethic and guidelines
2. Cooperation with Other Researchers
3. Understanding for research environment, obtaining research grants, and manner in the laboratory
4. Improving skills; experimental planning, experimental protocol, bibliographic survey, reading ability of research science paper, and application of patent
5. Acquisition; experimental techniques, analysis skills, writing research papers, manner of submission to science journal and peer review, establishment of research environment, and obtaining grants
6. Leadership; teaching next generation researchers



Center Professor
Kotaro Yamakado

## Research Field : Sports Medicine (Department : Sports Medicine Center)

【Research Fields】
- Epidemiology and Prevention of Sports Injuries and Disorders
- Exercise Therapy and Rehabilitation Science
- Functional Assessment Through Biomechanics
- Integrated Research on Exercise Physiology, Monitoring, and Data Analysis
- Evaluation of Exercise Interventions in Older and Younger Populations
- Development of Predictive Models Using AI and Machine Learning (Injury, Pain, Return to Sport)
- Establishment and Evaluation of Multidisciplinary Sports Medicine Systems
- Diagnostic Imaging and Treatment Assessment of Musculoskeletal Disorders (Ultrasound)
- Connection Between Psychological Factors and Sports Performance

【Research Goals】
- Development of early detection models for muscle injuries and joint disorders using ultrasound diagnostic devices.
- Establishment of treatment protocols for sports injuries with extracorporeal shock wave therapy and related modalities.
- Identification of risk factors for sports injuries and designing prevention programs.
- Development of clinical indicators to measure the effects of exercise therapy.
- Standardization and clinical implementation of strength, flexibility, and balance assessments.
- Creation of exercise prescription guidelines customized for age, sex, and sport-specific traits.
- Building and evaluating outcomes of community-based sports medicine networks.



Distinguished Professor appointed by the Chairman of the Board
Yutaka Kimura

## Research Field : Health Science (Department : Health Science Center)

【Research Fields】
The **Laboratory of Health Science** at Kansai Medical University engages in **multidisciplinary and translational research** encompassing the fields of **exercise science, psychology, nutrition, oncology, sports medicine (orthopedics and cardiovascular medicine), and public health**. Our research spans a broad spectrum of health-related domains, including **hemodynamics, metabolism, skeletal muscle physiology, arteriosclerosis, anti-aging medicine, and brain function**.

In collaboration with the **Health Science Center of Kansai Medical University Hospital** and affiliated institutions, we pursue both **cross-sectional and longitudinal investigations** aimed at bridging basic and clinical medicine. Ongoing projects include **behavioral medicine for clinical practice, ICT-based assessment of daily biological data**, and the **development of evidence-based intervention programs** utilizing wearable sensors, management applications, and both **non-SaMD and SaMD** platforms.

In addition, we are fostering an **integrated Health Business MBA (Master of Business Administration)** initiative that harnesses these research activities to establish **cost-effective intervention systems** and innovative **healthcare business models**. This program promotes collaboration with **specialized medical institutions, community health organizations, fitness facilities, and governmental bodies**, thereby advancing the practical implementation of health science in society.

Main Research Themes:
1. **Exercise Physiology:** Elucidation of exercise effects through analysis of skeletal muscle function, circulatory dynamics, metabolic factors, and autonomic regulation.
2. **Behavioral and Cognitive Science:** Investigation of the interrelations among obesity, brain function, cognitive behavioral therapy, and eating behavior.
3. **Digital Health and Data Science:** Development of novel health indicators and personalized intervention systems through big-data analysis of biological signals obtained from ICT-based wearable biosensors.

【Research Goals】
1. To acquire a comprehensive understanding of **health-related medical sciences**.
2. To develop a solid foundation in **exercise physiology, nutrition, and psychology**.
3. To cultivate expertise in **behavioral medicine**, with a focus on **cognitive behavioral therapy**.
4. To formulate independent research questions, supported by a deep understanding of **theoretical frameworks and previous studies**.
5. To master **statistical and analytical methods** applicable to experimental and observational data.
6. To attain the ability to **communicate and present scientific findings** effectively in both academic and professional contexts.



Professor
Tomoki Kitawaki

## Research Field : Mathematical Sciences (Department : Mathematics)

【Research Fields】

Our research aims to deepen scientific understanding and improvement by abstractly modeling concrete phenomena, mathematically analyzing based on logic, and positively impacting the global community through math. We also study biostatistics, which has diversified in recent years.

The role of mathematics in the medical world is foster improvement, by abstractly modeling concrete phenomena, mathematically analyzing based on logic, and positively impacting the global community. There are a wide variety of medical research subjects. Thus, to apply mathematical methods to research on any subject, it is important to express the actual data and biological signals with a mathematical model that is physically and mathematically meaningful to pursue the principle. The mathematical models used for such mathematical analysis are diverse depending on the research subject, and there are various methods of medical statistics, which have diversified in recent years.

Therefore, with the utilization of such mathematics in the medical field in mind, the Laboratory of Mathematics aims to improve the ability to use mathematics as a tool, which can be used for a wide range of purposes from basic studies to clinical applications, and we hope to give back to the entire university community through our endeavors. Additionally, with the increasing importance of medical statistics in clinical research, we will develop research support activities that apply medical statistics.

【Research Goals】

1. To acquire a systematic knowledge of mathematical models.
2. To acquire the ability to promote research independently.



Professor
Shinji Hirano

## Research Field : Cell Biology (Department : Biology)

【Research Fields】

The human central nervous system, consisting of complex neural circuits, performs higher-ordered neural activities including emotions and memory. Cell adhesion molecules protocadherins, which have a diverse variety, are specifically expressed in the nervous system, and they are thought to be responsible for complex cell-cell interactions, such as the formation of neural circuits and synapses. Research on protocadherins is getting attention as it has been reported in recent years that some protocadherin genes are associated with psychiatric disorders, including autism. In the Laboratory of Biology, we study the roles of protocadherin molecules in neural circuit formation and higher brain function at the molecular and cellular levels using knockout mice lacking protocadherin genes. We have found that the genes for protocadherins 1 and 9, which are related to autism, are specifically expressed in the hippocampus and amygdala and that knockout mice lacking these genes have abnormal emotional behaviors. We aim to elucidate the molecular mechanism of protocadherin-mediated emotional behaviors and explore the relationship within human psychiatric disorders in the future.

【Research Goals】

1. To understand cell adhesion molecules.
2. To understand neural circuit formation and neural function.
3. To learn basic techniques related to cell and developmental biology.
4. To set a research topic and understand the necessary theory and previously published data.
5. To perform statistical analysis based on experimental data.
6. To present research content appropriately.



Professor
Raoul Breugelmans

## Research Field: English for Medical Purposes Education (Department: English)

【Research Fields】
English education at healthcare universities is premised on the "acquisition of the English skills needed by medical professionals." The Department of English, therefore, conducts research on the skills and knowledge that physicians and other healthcare professionals need in order to function using English at different stages in their careers, as well as the most effective ways of acquiring, teaching and assessing those skills and knowledge sets from the perspectives of applied linguistics, pedagogy and publication science.

Main research topics

English for medical purposes (EMP) pedagogy and assessment
From the perspectives of applied linguistics and pedagogy, we are working toward the development and validation of various EMP teaching and assessment methods. We also aim to develop and validate a program evaluation and quality control mechanism to verify, based on various indicators, whether the set goals for EMP education are actually achieved at the time of graduation. Our long-term aim is to standardize the educational objectives, teaching methods, and assessment methods of EMP education.

Linguistic analysis of English for medical purposes
We are conducting research to elucidate the nature of English as it is used in various genres in the medical field using linguistic methods such as genre analysis, discourse analysis, conversation analysis, and corpus analysis, with the aim of applying the results to the development of more effective EMP education.

International medical communications research
Also referred to as publication science or journalology, international medical communications research is a field that deals with various aspects of the dissemination of information in medicine, such as the reporting of biomedical research results in journals and at academic conferences. Research topics include the peer review system, publication ethics, publication bias, researcher and journal evaluation metrics, and reporting guidelines and recommendations.

【Research Goals】
1. Be able to develop EMP teaching methods and evaluate their educational effectiveness
2. Be able to develop EMP assessment methods and evaluate their validity and reliability
3. Be able to use linguistic methods to systematically identify the characteristics of EMP
4. Be able to explain all aspects of the written and oral dissemination of information in medicine



Professor
Megumi Kondo

## Research Field: Death and Life Studies (Department: Medical Behavioral Science)

【Research Fields】
The Department of Behavioral Medicine engages in interdisciplinary and international research on life and death, an enduring human concern that remains unresolved despite significant advances in medicine and healthcare. Grounded in the field of life and death studies, the department collaborates with researchers worldwide to investigate areas that have often been overlooked in academic discourse.

Main research topics

**1. Reexamining Death Across the Life Course**
Contemporary societies are increasingly confronted with the immediacy of death due to demographic aging, recurring natural disasters, and geopolitical instability. Individuals are more frequently exposed to the sudden loss of their own lives or those of loved ones. The department conducts comparative and international studies across the life course to construct new theoretical frameworks aimed at enhancing quality of life (QOL).

**2. Exploring the Ethics of Life and Death**
Healthcare professionals are routinely required to make ethically complex decisions at both the beginning and end of life. As reproductive and end-of-life care options continue to diversify, the need for timely and ethically sound decision-making has become increasingly critical. While bioethics emphasizes principles such as autonomy and informed consent, the capacity to navigate ethical dilemmas and support patient choices is now essential. The department investigates the foundations and cultural variability of ethical decision-making, examines the psychological conflicts experienced by patients, families, and healthcare providers, and contributes to global ethical discourse.

**3. Advancing Death Education for Healthcare Professionals**
Although the importance of death education is widely acknowledged, significant challenges remain regarding pedagogical approaches and outcome evaluation. Life and death studies are inherently interdisciplinary, encompassing the humanities, natural sciences, and the arts. For healthcare professionals who support patients through illness, aging, and dying, these studies offer a reflective framework for examining personal values and clinical experiences. The department also develops educational programs that foster the capacity for sustained reflection on life and death throughout one's professional development.

【Research Goals】
1. To develop theoretical and practical models that enhance quality of life across the life course by critically reexamining death in contemporary contexts.
2. To contribute to global bioethical discourse on patient autonomy, cultural diversity, and the psychological dimensions of life-and-death decision-making.
3. To establish innovative, interdisciplinary models of death education that cultivate reflective and compassionate healthcare professionals.



Center Professor
Katsumi Nishiya

## Research Field: Medical Education (Department: Center for Health Professions Education)

【Research Fields】
Our program aims to nurture researchers who understand the fundamentals of world-standard medical education, who can grasp educational theory through educational practice, who can collect and analyze data necessary for medical education research, and who can formulate their research plans. Our program deals with research related to medical education as well as various area of medical professions education.

【Research Goals】
1. To be able to understand basic theories of medical education.
2. To be able to practice education based on the theories of medical education
3. To be able to understand and utilize research methods in medical education
4. To be able to plan and carry out medical education research
5. To be able to present research details appropriately



Distinguished Professor appointed by the University President
Giuseppe Pezzotti

## Research Field: Molecular Medicine (Department: Biomedical Engineering Center)

【Research Fields】
1. Analysis of molecular medicine using Raman spectroscopy.
2. Development of preventive medicine and early diagnostic methods centered on Raman spectroscopy.

【Research Goals】
1. Understand the applications of Raman spectroscopy in molecular medicine.
2. Understand the concepts of Raman spectroscopy in cell physiology.
3. Acquire basic techniques for the multi-omics analysis of bacteria, fungi, and viruses.
4. Become able to define a research question by understanding relevant theories and previous findings.
5. Study the chemical origins of various pathologies and become capable of diagnosing their risk.
6. Become able to perform statistical analysis of experimental data.
7. Become able to present research findings effectively.
8. Become able to summarize research findings in appropriate scientific English and publish them as an academic paper.

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