Research Fields

2023

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 cross-disciplinary group that brings together specialists in regenerative medicine research on the heart, liver, kidney, endocrine organs, blood, and skeletal muscle. Our three aims are as follows:

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

2. Generating disease models to elucidate mechanisms.
   We generate disease models by inducing differentiation of human iPS cells. Although it is difficult to reproduce human diseases in vitro, we examine the mechanisms of diseases using pathological models with newly generated human iPS cells. In addition, we establish iPS cells from patients to determine pathophysiology and develop treatment methods.

3. Aiming for clinical application.
   Cells induced from human iPS cells are used for the screening and efficacy evaluation of drugs. We aim not only for drug evaluation but also for drug discovery.

【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 the Innovative Regenerative Medicine Department of the Graduate School of Medicine, led by Dr. Fumiyuki Hattori, we are actively working on the development of regenerative medicine of the heart, liver, pituitary gland, and salivary gland, as well as a wide range of research themes in the fields of COVID-19, skin, nail, skeletal muscle, cellular senescence, AI, and robotics, all through the lens of a new, creative perspective. The Innovative Regenerative Medicine Department has built collaborations with multiple companies in a wide range of industries, and a total of 20 aspiring members with diverse backgrounds have gathered to create a free and open atmosphere.

【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
Keiko Muguruma

Research Field: Brain Development and Formation (Department: iPS Cell Applied Medicine)

【Research Fields】

One of the ultimate goals of neuroscience is the scientific understanding of the development, structure, and function of the human brain, the center of mind and intelligence, as well as the treatment of neurological and psychiatric disorders. However, approaches to human brain research are limited to non-invasive image analysis, such as MRI/PET, and the use of autopsied brains and cell lines, thus empirical research on the human brain itself has been a challenge. Nevertheless, detailed measurement and analysis at the genomic, molecular, cellular, and tissue levels using human samples are needed for understanding the human brain's unique structure and function, as its complex structure and function are qualitatively different from those of other animals. In light of these restrictions, we believe that advancements in human brain research would be made with the innovation of brain organoids from pluripotent stem cells. In our department, we advance our research by utilizing pluripotent stem cells and organoid technology to scientifically understand the human brain with the goal of contributing to conquering intractable diseases through the understanding of biological phenomena. We aim to understand neuropathological conditions, including intractable neurological diseases, intractable ocular diseases, neuroendocrine disorders, and congenital brain disorders, by reproducing organ development with ES/iPS cells and modeling disorders. Through collaborative research with various clinical and basic researchers inside and outside the university, promotion of cross-disciplinary collaboration, such as the development of image analysis techniques and culture materials, and cooperation of patients, we aim to understand the human brain and develop drugs and treatments to conquer intractable diseases and rare disorders.

【Research Goals】

1. To learn basic and latest knowledge of embryology and neuroscience.
2. To be able to acquire and make full use of differentiation induction technology of pluripotent stem cells, imaging technology, and quantitative analysis technology.
3. To be able to plan and carry out experiments related to the research on the structure, function, development of the brain and disease research.
4. To be able to analyze and interpret experimental results correctly.
5. To be able to present research results appropriately.

Professor
Toshimasa Nishiyama

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

【Research Fields】

In our department, the Department of Hygiene and Public Health, we aim to educate researchers who can understand preventive medicine and human health management and/or health hazards from the global fields, including infectious prevention, tropical medicine, international health, and elderly care. We expect the student can understand the current issues through field surveys and experiments, collect and analyze data necessary for research, and independently design experimental plans.

One of our current research topics is human health management and health hazards for international health, especially in developing countries. To prevent infectious diseases, we focus on epidemics surveys of dengue fever in the Lao PDR. We also conduct the research for developing a dengue fever control program by using mosquito larval insecticide and genetically analyzing the genealogical tree of dengue virus, which is the pathogen of dengue fever. We keep challenging to resolve the world wide problems in international health and serious infections diseases.

Additionally, we also address the issue on the ageing society and aged care. It is important for ageing people to keep the quality of life (QOL) and avoid long-term care. Therefore, we investigate to improve the frailty for aged people.

【Goals】

1. To be able to understand the structure and function of human health.
2. To understand the legal system in public health.
3. To learn basic techniques for identifying pathogens, as well as diagnosing tropical diseases.
4. To learn basic techniques related to the health management of overseas travelers, such as vaccinations.
5. To conduct and evaluate/analyze the health surveys of caregivers and those in need of nursing care in aged care.
6. To set a research task, and to understand logically for the theory and previous papers.
7. To be able to perform statistical analysis based on experimental data.
8. To be able to present research results appropriately.

Professor
Toshimasa Nishiyama

Research Field: Molecular and Cell Biology (Department: Hygiene and Public Health)

【Research Fields】

The field of Molecular and Cell Biology aims to develop researchers who can understand the basic principles of cell biology and genetic engineering by conducting basic and clinically relevant medical research, using knowledge and techniques in biotechnology, as well as independently formulating experimental plans by collecting and analyzing the data necessary for research.

Our current research themes include the practical application of diagnostic kits using novel biomarkers for tuberculosis infections. Tuberculosis, which causes droplet nuclei infection, is a serious infectious disease that spreads if the diagnosis of active tuberculosis is delayed, requiring global public health measures. Thus, using samples that can be easily obtained without collecting blood, we began our research on a new rapid diagnostic method for active tuberculosis that can be easily and quickly performed even in developing countries. In collaboration with researchers in the Lao People's Democratic Republic, we have successfully detected an index that could be a diagnostic biomarker of active tuberculosis. We aim to further examine the results of this preliminary research and to develop a new tuberculosis diagnostic kit that can quickly and reliably identify a tuberculosis infection using a novel biomarker.

Furthermore, we try to clarify the mechanisms of traditional Chinese herbal (Kampo) medicine at the molecular level against menopausal diseases and osteoporosis. Kampo is a natural product of herb and some of them has estrogenic activity. In order to evaluate the effects of Kampo medicine especially against osteoporosis, we conduct the research in vitro and in vivo.

【Research Goals】

1. To understand the concept of molecular and cell biology.
2. To understand the characteristics of bacterial and viral infections.
3. To learn basic molecular and genetic laboratory techniques.
4. To set a research topic and understand the necessary theory and matters that have been revealed previously.
5. To be able to read the information in the experimental data and explain the phenomenon.
6. To be able to summarize research content and present it appropriately.

Research 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
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.

Professor
Tatsuo Kinashi

Research Field: Molecular Immunology (Department: Molecular Genetics)

【Research Aims】

The immune system protects the body from pathogenic microorganisms. For this purpose lymphocytes, which are essential immune cells for the acquired immunity, have the ability to patrol for foreign substances as they recirculate between the blood and lymphatic systems throughout the body. T lymphocytes have the ability to react only to dangerous foreign antigens by distinguishing between self and non-self. Our research aims for elucidation of the mechanisms regulating adhesive interactions of lymphocytes that support these remarkable trafficking and antigen recognition, and development of therapeutics for immune diseases, as described below:

1. Elucidation of the molecular mechanism of integrin activation. The integrin adhesion molecule LFA-1 plays an essential role in lymphocyte trafficking and antigen recognition of lymphocytes. In resting lymphocyte basal LFA1 affinity is maintained at low levels. Upon stimulation with chemokines or antigens, LFA-1(αLβ2) on lymphocytes is converted from inactive low-affinity to active high-affinity states, suitable for attachment to endothelial cells and antigen presenting cells. Using live imaging at single-molecule levels, we have discovered that this process requires two inside-out signal pathways from the small G protein Rap1 to recruit integrin adaptors talin1 and kindlin-3 to the specific sites of the β2 tail: one pathway involves a Rap1 binding protein, RAPL, which activates Mst1 and NDR1 kinases to recruit kindlin-3, and the other pathway involves direct recruitment of talin1 by Rap1. We are investigating how these pathways coordinately regulate ligand binding and how ligand-bound LFA1 transmits outside-in signaling to alter cell shapes, and to induce lymphocyte growth and differentiation.

2. Elucidation of immunological diseases due to impaired adhesion and migration of immune cells. During generation of T cells in the thymus, some T cells react self-antigens. The process of eliminating such self-reactive T cells in the thymus is called negative selection, and intractable diseases known as autoimmune diseases occur if this process fails. To pursue its mechanism, we successfully set up two-photon live-imaging of the negative selection process for the first time and discovered that the adhesion molecule LFA-1/ICAM-1 and Mst1 are necessary for the negative selection process.

3. Pursuing drug discovery for integrin-related diseases. As the involvement of integrin activation has been reported in many diseases such as autoimmune diseases and cancer, we are working to develop drugs for integrin-related diseases that control integrin activation. We are testing whether the inhibitor candidates for the proteins of interest selected based on in silico docking simulations with a library of 10 million compounds, as well as the drug candidates we designed, are effective for integrin-related disease models.

【Course Objectives】

1. To understand the mechanisms of the immune system and perform basic experiments using immunological and molecular/cell biology techniques.
2. To learn how to generate mouse models of immune diseases and examine pathophysiology and measure treatment efficacy in vivo.

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.

Distinguished Professor appointed by the University President
Koichiro Higasa

Research Field: Genomic Medicine (Department: Genome Analysis)

【Research Fields】

Our department promotes exploratory research on genetic factors related to the onset and prognosis of various diseases for the development of Precision Medicine, which is personalized medicine based on genome information. Our research targets the entire human genome, which contains a huge amount of information, to elucidate the causes of diseases using statistical genetics and comprehensive advanced bioinformatics approaches, such as cutting-edge machine learning and parallel computing techniques. In 2013, we launched the first database of genetic variation in the Japanese population, the Human Genetic Variation Database (HGVD), which has facilitated refined genetic analyses such as the efficient survey of causative mutations associated with intractable diseases or cancer, precise genotype imputation in genome-wide association studies, and prediction of side effects of drugs. Dissemination of genomic information by means of HGVD is expected to have applications in the future development of personalized medicine.

【Research Goals】

1. To develop theories and analytical technologies related to statistical genetics and bioinformatics.
2. To construct algorithms and techniques for performing genome analysis to explore disease-related genetic factors.
3. To acquire knowledge related to promoting personalized medicine and genetic diagnosis based on genomic information.
4. To develop skills for making research plans, conducting research, and publishing papers.

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.

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.

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
Ichiro Shiojima

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

【Research Fields】

- Myocardial regeneration using human heart-derived tissue stem cells: We have found human circulating blood contains progenitor cells that can differentiate into cardiomyocytes, smooth muscle cells, and endothelial cells. These cells, expressing mesenchymal stem cell markers and vascular endothelial cell markers, are called circulating mesangioblasts (cMAB). We work to apply cMAB to myocardial regeneration, in addition to clarifying their origin.
- Search for the causative gene of hereditary kidney disease: We are searching for the causative gene of hereditary kidney disease that develops due to a single gene mutation. Chronic kidney disease (CKD) is a multifactorial disease, and we aim to establish new treatment methods for CKD through elucidation of the pathophysiology of hereditary kidney disease.
- Effects of postprandial hyperglycemia on the functions of bone marrow: Postprandial hyperglycemia has been shown to play an important role in the development of macrovascular diseases associated with diabetes. We are working to understand the pathogenic mechanism of macrovascular diseases derived from diabetes by investigating the effects of postprandial hyperglycemia on vascular endothelial progenitor cells in the bone marrow.

【Research Goals】

1. To set a research theme and make a research plan.
2. To learn the methodology required for research planning.
3. To interpret the obtained data and plan necessary experiments and data collection.
4. To present research content appropriately.
5. To publish research results as scientific papers.

Clinical Professor
Nagaoki Toyoda

Research Field: Endocrinology and Metabolism (Department: Internal Medicine Ⅱ)

【Research Fields】

Thyroxine (T4), which is secreted mainly from the thyroid gland, is considered a precursor hormone and is converted to the active hormone 3,5,3′-triiodothyronine (T3) by the 5′-deiodination reaction. On the other hand, T4 is also converted to the inactive hormone 3,3′,5′-triiodothyronine (reverse T3) by the 5-deiodination reaction. The 5′-deiodination reaction is catalyzed by type 1 and type 2 iodothyronine deiodinases (D1 and D2, respectively), while the 5-deiodination reaction is catalyzed by type 3 iodothyronine deiodinase (D3). Thus, intracellular T3 concentration is increased by D2 while decreased by D3. In fact, D3 gene-deficient mice (D3KO) have impaired glucose tolerance, and secretion of glucose-responsive insulin is reduced in islets isolated from D3KO mice. Our research aims to elucidate the physiological significance of D3 in the process of differentiation and maturation of human iPS cells into pancreatic β cells.

【Research Goals】

1. To understand the mechanisms of carbohydrate metabolism and the expression of thyroid hormone actions.
2. To learn cell culture methods and molecular biology methods.
3. To set a research topic and understand the necessary theory and matters that have been revealed previously.
4. To perform statistical analysis based on experimental data.
5. To present research content appropriately.

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
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】

a. Cerebral small vessel disease: Cerebrovascular disorders that cannot be detected on image analyses are involved in stroke, dementia, and aging. Methods for evaluating cerebral small blood vessels from various aspects using lesions on brain MRI, as shown in Figure 1, have been recently proposed. We aim to clarify the clinical significance of cerebral small vessel disease by constructing a scoring model using these images:

Figure 1. Representative images of neuroimaging markers for cerebral small vessel disease

b. Basal ganglia: Drug efficacy is known to diminish with the progression of Parkinson's disease, and we aim to elucidate the pathophysiology of the underlying mechanism using Parkinson's disease model animals. We evaluate the effects of various drugs by using unilateral Parkinson's disease model rats, which are generated by injecting 6-OHDA into one side of the medial forebrain bundle (MFB).

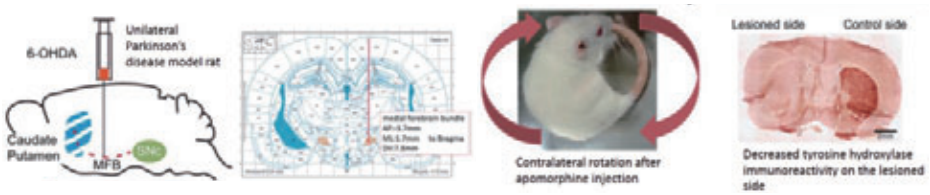


Figure 2: Experiments of Parkinson's disease model animals

c. Neuropathology: Through immunohistological examinations of human brain specimens and gene expression/protein analyses of frozen autopsy materials, we aim to elucidate the pathogenic mechanism of various neurodegenerative diseases and develop treatment methods rooted in the pathophysiology. Our research mainly targets amyotrophic lateral sclerosis, progressive supranuclear palsy, and frontotemporal dementia.

【Research Goals】

1. To be able to understand the molecular pathology of neuromuscular diseases and cerebrovascular diseases.
2. To learn basic research techniques and methods necessary for elucidating the above pathological conditions.
3. To choose a research issue in the research topics below and understand the necessary theory and published data.
4. To make a research plan to solve the research issue, carry out the research under the guidance, and report the results regularly.
5. To publish the results of the above goals as peer-reviewed papers.

Professor
Toshihiko Kinoshita

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 advancements 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 the body, 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 inflammatory bowel disease, irritable bowel syndrome, neonatal necrotizing enterocolitis, allergies, autism, obesity, diabetes, autoimmune diseases, and sudden infant death syndrome. Thus, our laboratory in the Department of Pediatrics of Kansai Medical University is studying dysbiosis of the intestinal flora in various diseases of young children using next generation sequencing. Our results suggest that dysbiosis due to cesarean delivery may be corrected with a small amount of breast milk feeding. Furthermore, we have demonstrated that the proportion of butyric acid-producing bacteria is reduced in patients with idiopathic nephrotic syndrome and that the number of recurrences can be reduced by the administration of butyric acid-producing bacteria.

【Goals】

1. To understand the physical and psychological characteristics of healthy children.
2. To understand the characteristics of diseases of young children.
3. To understand the basic techniques of gene analysis.
4. To perform basic handling of experimental animals.
5. To learn the basic techniques of cell culture.
6. To set a research topic and to study and understand the necessary theory and previous research.
7. To be able to perform correct statistical analysis based on experimental data.
8. To be able to present research content appropriately.

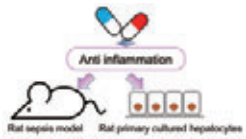
Professor
Mitsugu Sekimoto

Research Field : Surgery (Department : Surgery)

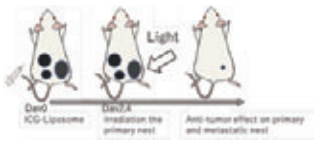
【Research Fields】

①We investigate the effects of virus therapy with third-generation proliferative recombinant HSV-1 (T-01) as a novel treatment for advanced liver cancer, treatment-resistant sarcoma, and neuroendocrine cancer. T-01 is an oncolytic virus that elevates the efficacy and safety of G207, which has been shown to be effective against various human tumors in nonclinical studies, and enhances antitumor immunity.

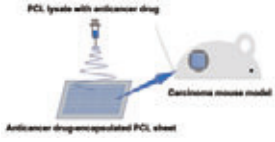
②Sepsis is a highly lethal pathological condition accompanied by inflammation, and effective therapeutic agents and methods for sepsis have not been established. We aim to develop drugs with an anti-inflammatory action that are highly effective against sepsis by using an evaluation system that combines ex vivo (primary cultured hepatocytes) and in vivo (endotoxin sepsis model) data with the use of a rat animal model.



③The indocyanine green (ICG) liposome, developed as a drug delivery system (DDS) preparation, has a hyperthermic effect, a photodynamic effect, and an antitumor effect due to local release of an anti-cancer drug, all of which are triggered by near-infrared irradiation. ICG is expected to induce cancer immunity by releasing cancer antigens. We are investigating its effects as a next-generation photoimmunotherapy.



④In anti-cancer drug treatment, it is important for the drug delivery system (DDS) to allow a higher dose of drugs or drugs at effective concentrations to maintain their antitumor effects for a long period of time. We are developing a novel DDS using a polycaprolactone (PCL) sheet that encapsulates anti-cancer drugs, aiming to exert an antitumor effect effectively and continuously with a smaller amount of anti-cancer drugs compared to their systemic administration.



【Research Goals】

1. To understand the pathophysiology of diseases in gastrointestinal surgery, breast surgery, and pediatric surgery.
2. To understand the latest advances and new research prospects in surgery.
3. To set a research topic and understand the necessary theory and previously discovered evidence.
4. To perform statistical analysis based on experimental data.
5. To present research content appropriately.

Clinical Professor
Masaki Kaibori

Research Field: Liver Surgery (Department: 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.

Clinical Professor
Sohei Satoi

Research Field: Pancreatobiliary Surgery (Department: Surgery)

【Research Fields】

Basic research

① Search for new targets of photoimmunotherapy for pancreatic cancer using the nCounter analysis system.
② Comprehensive analysis of the microbiome in pancreatic cancer using the ultracompact nanopore sequencing device, MinION.
③ Analysis of biomarkers that predict responses to therapies for peritoneal disseminated pancreatic cancer.
④ Determining expression profiles of adipophilin in biliary pancreatic cancer and clinical pathological examinations.
⑤ Research on the presence of cancer-related fibroblasts, cancer stem cells, and prognoses in biliary pancreatic cancer.
⑥ Research on the expression of Caspase 3 (immunostaining) and the assessment of therapeutic effects of preoperative treatments in pancreatic cancer.
⑦ Research on the expression of intermediate filaments of the nervous system, such as peripherin and internexin, as well as related proteins, and prognosis in pancreatic neuroendocrine tumors.
⑧ Research on pathological tumor shrinkage patterns after preoperative chemotherapy/radiotherapy and prognosis in pancreatic cancer.
⑨ Examination of the association between the proportion of acinar cells in pancreatic segments and postoperative pancreatic fistula.
⑩ Pathological and genetic analysis of ascites via cyto-diagnoses during pancreatic cancer surgery.

Clinical research (representative/specific research)

⑪ A multicenter, phase III randomized controlled trial to examine the usefulness of intravenous/intraperitoneal combination 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 borderline resectable 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).

Many other studies are being conducted.

【Research Goals】

1. Be able to set a research agenda and develop a research plan to resolve outstanding issues
2. Learn immunogenetic approaches using clinical specimens and implement them appropriately
3. Be able to create a database from research data (including data cleaning) and conduct appropriate statistical analysis
4. Be able to carry out research appropriately as a member of a clinical research team
5. Be able to present research appropriately in Japan and abroad
6. Be able to summarize research in English

Clinical Professor
Tomoharu Sugie

Research Field: Breast Surgery (Department: Surgery)

【Research Fields】

Breast cancer is heterogeneous, as its internal kinetics of tumor growth and metastasis is determined not only by the biological characteristics of the tumor itself, but also by its interaction with immunity. In the Breast Surgery Department, we construct a tissue microarray of triple-negative breast cancer (TNBC) to study the biology of immune and stromal cells in the tumor microenvironment using immunohistological techniques, in collaboration with the Department of Pathology and Laboratory Medicine. Currently, we are analyzing the relationship between the expression of biomarkers, such as PD-L1 (programmed cell death ligand-1) and PD-L2, in tumor-infiltrating lymphocytes and stromal cells of TNBC and prognosis. Furthermore, in collaboration with Kyoto University, we are studying the molecular mechanism behind the differentiation and drug resistance of hormone receptor-positive breast cancer by generating breast cancer organoids from needle biopsy and surgical specimens. The construction of the breast cancer disease model using these organoids is expected to lead not only to the development of individualized treatments for breast cancer but also to the identification of target molecules of new drugs.

【Research Goals】

1. To be able to understand the clinical pathology of breast cancer.
2. To understand the immuno-molecular biological mechanisms of the development, growth, and metastasis of breast cancer, as well as biological defense mechanisms.
3. To plan and execute clinical trials based on preclinical data.

Clinical Professor
Takashi Doi

Research Field: Pediatric Surgery (Department: 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
Naoki Minato

Research Field: Cardiovascular Surgery (Department: Cardiovascular Surgery)

【Research Fields】

During a coronary angioplasty, including an endarterectomy＋onlay grafting, for patients with difficult bypass procedures, late remodeling of the region of coronary artery formation can occur, resulting in a phenomenon in which the coarse lumen becomes smooth after the removal of the inner lining, having the same diameter as the native coronary artery, and appears normal. In such cases, OCT shows the formation of a new inner lining in the coronary artery after angioplasty, and patency is maintained. Our clinical research investigates the mechanism of inner lining regeneration that causes this favorable remodeling phenomenon.

【Research Goals】

1. To understand the structures and functions of the heart and vascular system, and learn basic techniques for diagnostic methods, surgical treatment methods, and postoperative management.
2. To set a research topic, perform statistical analysis based on literature and experiments, and publish valid research.

Clinical Professor
Hiroyoshi Komai

Research Field: Vascular Surgery (Department: Cardiovascular Surgery)

【Research Fields】

Peripheral artery disease (PAD), is known to have a poor prognosis even with mild leg symptoms. In the Department of Vascular Surgery, we study approaches to improve the prognoses of patients especially with mild PAD. We clinically examine whether the subsequent quality of life can be improved by screening for the risk factors of heart, cerebrovascular, and other fatal arteriosclerotic diseases, which are thought to occur even in approximately 40% of mild case patients. We also investigate the involvement of lipid-based markers, which are important risk factors in coronary artery diseases, in the development of PAD in large-scale observational studies. On the other hand, our studies on severe cases (chronic limb threatening ischemia) focus on early detection of severe ischemia for prompt diagnosis and appropriate treatment. We have developed a novel method for detecting the blood flow wave of the toes and measuring the severity of ischemia of the lower limb with ease, which is currently tested in clinical practice in a prospective study. In the Vascular Surgery Department, we are committed to conducting clinically applicable research, and we aim to improve the prognoses and quality of life of patients with PAD through these studies.

【Research Goals】

1. To become knowledgeable on anatomy, physiology, pathology, and symptomatology of arterial and venous diseases.
2. To learn the treatment and surgical methods for the above diseases.
3. To accurately focus on the clinical problems of the above diseases and conduct research to solve them.
4. To disseminate research results domestically and internationally.
5. To become a leader of researchers in the same field.

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
Akio Asai

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

【Research Fields】
Cancer stem cells are garnering research attention as a cause of cancer recurrence and metastasis. In our department, we discovered novel molecular targets from the cancer stem cells established from brain tumors. Thus, we are now working to identify new biomarkers for cancer recurrence and develop therapeutic agents. We also discovered that cancer stem cells highly express regulatory T-cell modulators and demonstrated novel data that regulatory T-cell modulators affect prognoses. Based on these findings, we aim to develop immunotherapy for malignant brain tumors.

We also research congenital malformations in children. Spina bifida is the most common among those disorders, and the identification of its cause, as well as the development of its diagnosis, treatments, and prevention methods, is needed. We are working to find gene mutations specific to spina bifida through whole-genome analysis of specimens from patients with familial spina bifida.

【Research Goals】
1. To understand the pathophysiology and pathogenic mechanisms of neurosurgical diseases.
2. To understand the treatment methods for neurosurgical diseases.
3. To understand the pathophysiology and pathogenic mechanisms of malignant brain tumors.
4. To understand antitumor immunity.
5. To understand the characteristics of neural stem cells.
6. To learn basic techniques such as cell culture, flow cytometry, and immunohistochemical staining.
7. To acquire the ability to determine applicable research need through conference activities and literature reviews.
8. To acquire the ability to set testing methods necessary for solving the problem.
9. To gain statistical knowledge for testing experimental data.
10. To acquire the ability to present research content appropriately.
11. To acquire the ability to publish research content as papers.

Professor
Takanori Saito

Research Field: Orthopedic Surgery (Department: Orthopedic Surgery)

【Research Fields】

① Ricoh (Tokyo, Japan) has developed a magnetospinography system that measures biomagnetism generated by neural activity and determines the site of neuronal injury. In 2019, our department constructed a new research facility on the premises of KANSAI MEDICAL UNIVERSITY to conduct clinical research on the spinal cord and peripheral nerve disorders as joint research between senior Saito, Ph.D and the company.

② Implant infection is a major problem of general postoperative complications. Bacteria may not be detected by current culture tests if antibacterial agents have been administered or if the bacteria are anaerobic. Our department has established a method suitable for the identification of bacterial genes using next generation sequencing and is conducting research for its clinical application.

③ Intraoperative spinal cord monitoring is essential in cases in which myelopathy is a concern during surgery, but an optimal measurement method has not been established. There are several measurement methods for nerves, including motor and sensory nerves, and their reproducibility and sensitivity vary depending on the depth of anesthesia, the number of stimulations, and the disorder of the spinal cord itself. The Department of Orthopedic Surgery at Kansai Medical University, which is accredited as an educational facility for intraoperative monitoring and visited by many physicians and medical technicians for training every year, is working on new methods of intraoperative spinal cord monitoring.

【Research goals】

1. To understand the structures and functions of bones, joints, ligaments, peripheral nerves, and spinal cord.
2. To understand the concept of the locomotorium.
3. To learn basic experimental techniques.
4. To set a research topic and understand the necessary theory and published data.
5. To perform statistical analysis based on experimental data.
6. To present research content appropriately.

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】

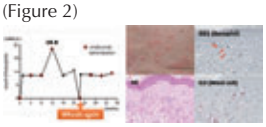
Examination of the mechanism of granuloma development using iPS cells derived from patients with the rare disease Blau syndrome (Figure 1)

(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.

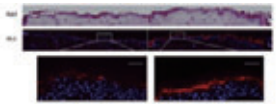
Examination of the migration of activated basophils from peripheral blood to skin (Figure 2)

(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.

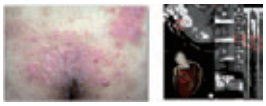
(Figure 3)



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
Kanji Takahashi

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

【Research Fields】

In the Laboratory of Ophthalmology, we study the mechanisms of age-related macular degeneration and pathological neovascularization in diabetic retinopathy, and clinically apply the results. The experimental model of choroidal neovascularization is generated by laser photocoagulation, while the hypoxic retinopathy model similar to retinopathy of premature infants is generated by exposing experimental animals to high oxygen concentrations. In our basic research, we have efficiently reproduced these diseases with experimental model animals typically used in our laboratory for many years. Although our research previously focused on histology using electron and optical microscopes, we have been actively adopting molecular and cell biology approaches in recent years. Particularly, we are one of the laboratories with the largest numbers of patients and treatments for age-related macular degeneration, and are considered a center for the treatment of age-related macular degeneration. Taking advantage of this, we have established an ideal basic research-clinical cycle, in which we raise questions based on various clinical experiences, formulate a research plan to find their answers experimentally, conduct research by making full use of experimental animals and cells, and return to clinical practice to apply the obtained knowledge.

【Research Goals】

1. To be able to understand the structures and functions of the visual organs.
2. To understand the concept of intraocular neovascularization.
3. To learn basic techniques for generating the animal model of intraocular neovascularization and for cell culture.
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
Hiroshi Iwai

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

【Research Fields】

Despite the increasing number of patients with age-related hearing loss in developed countries, a preventive method for this type of hearing loss has not been established. We have shown that hearing loss progression in a model is prevented by systemic immune modification (rejuvenation) treatments, including bone marrow transplantation, thymic transplantation, and lymphocyte inoculation with young/fetal mice donors. We aim to understand this, establish clinically compliant immunomodulatory treatments, and examine their application to humans.

Our research also focuses on understanding eosinophilic airway inflammation, currently an intractable disease. We found a novel subtype of eosinophils present at the site of inflammation, and investigate novel biomarkers that we expect to be involved in the pathogenesis of activated eosinophils. We are pioneering a new field called “Airway Medicine,” a field that comprehensively views the entire airway from pathology to treatment.

【Research Goals】

1. To understand the anatomical structures and functional roles of the otology area, the upper airway (nasal/paranasal cavities, oral cavity, and pharynx) and lower airway, and the head and neck surgery area.
2. To learn handling and analysis methods of human clinical samples and data.
3. To learn animal handling based on animal welfare, as well as generation and analysis of disease mouse models.
4. To learn basic molecular biology techniques for analyzing samples.
5. To read original English papers.
6. To objectively evaluate experimental data using statistical methods and establish the ability to prepare presentations and papers in English.
7. To acquire an international sense through overseas joint research and presentations at international conferences.
8. To conduct research in collaboration with researchers inside and outside the university.
9. To plan and execute research in accordance with laws and regulations, such as codes of ethics and guidance on dangerous material disposal.

Professor
Noboru Tanigawa

Research Field : Radiology (Department : Radiology)

【Research Fields】

1. Diagnostic Imaging

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

We investigate the usefulness of concurrent chemotherapy and RI(Radio Isotope) treatment targeting cancer, and aim to develop imaging and therapeutic agents for RI-labeled lipiodol. In addition, we focus on a clinical understanding of pathological conditions, construction of efficient diagnostic methods, and aim to predict treatment effects for diseases like Parkinson’s diseases (i.e. dopamine transporter imaging), head and neck tumors (prediction of prognosis with F-18 FDG PET), lung cancer (prediction of the efficacy of immune checkpoint inhibitors), prostate cancer (oral Ra-223 therapy), and malignant lymphoma (radioimmunotherapy).

3. IVR(Interventional Radiology)

Using the animal imaging room, we study embolic agents, biological uses of nano-microbubbles, novel lymphatic IVR techniques, CT fluoroscopy IVR support systems, and the development of antithrombogenic and antibacterial catheters.

4. Radiation Therapy

We aim to clarify the usefulness and potential problems of high-precision radiation therapies, such as intensity-modulated radiation therapy (IMRT) and stereotactic body radiation therapy (SBRT), for various malignant tumors through basic experiments and clinical trials.

【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.

Professor
Hidetaka Okada

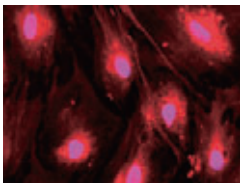
Research Field: Obstetrics and Gynecology (Department: Obstetrics and Gynecology)

【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.

Professor
Yasuyuki Kuwagata

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

【Research Fields】

Our emergency medicine laboratory on the 8th floor of the university building is equipped with a physiological experiment system, which uses a rabbit model of variable cardiac output to analyze the oxygen delivery/consumption relationship of an individual for the investigation of the nature of various pathological conditions. In our research, we generated a shock model with attenuating peripheral vascular resistance caused by the expression of pathological mediators, which mimics human septic shock, compared it to an equivalent attenuation of peripheral vascular resistance generated by external administration of vasodilatation mediators. Our recent publication demonstrated that, while the former has a pathological oxygen supply dependency in which oxygen consumption decreases depending on the decrease in oxygen delivery, the latter maintains a constant oxygen consumption level regardless of the amount of oxygen delivery. These results suggest that pathological decreases in oxygen consumption are caused not only by mere attenuation of vascular resistance but also by abnormal blood flow distribution at the site where pathological mediators are expressed.
(Our findings were published in the Acute Medicine and Surgery, an English journal of the Japanese Association for Acute Medicine)

【Research Goals】

1. To explain the pathophysiology of severe emergency cases seen in the Department of Emergency Medicine by aggressological theory and propose countermeasures.
2. To know the history and current status of emergency and disaster medicine and to be able to propose improvement methods needed for the next generation.

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
Yutaka Kimura

Research Field : Health Science (Department : Health Science)

【Research Fields】
The Laboratory of Health Science conducts multifaceted research related to exercise, psychology, nutrition, sports medicine (orthopedics and cardiovascular medicine), and health, and it covers a wide range of health-related areas, such as hemodynamics, metabolism, skeletal muscle function, arteriosclerosis, anti-aging medicine, and brain function. We also carry out behavioral medicine for practicing clinical medicine, evaluation of daily continuous biological information using ICT, and research and development of intervention programs using wearable sensors and management applications. The data are cross-sectionally and longitudinally examined in collaboration with the Health Science Center of the university hospital and related facilities.

Ultimately, we aim to open the world's first health business MBA course by making full use of these research programs for the construction of a cost-effective intervention system, collaboration with specialized medical institutions, community medicine, fitness facilities, and government, as well as research and develop business models.

Main Research Themes:
1. Research the effects of exercise by skeletal muscle function, circulatory dynamics, metabolic factors, and autonomic nervous function.
2. Understanding the relationship between obesity and brain function, cognitive behavioral therapy, and food behavioral science.
3. Development of new health indicators and intervention systems by analyzing biological big data using ICT wearable biosensors.

【Research Goals】
1. To understand the scheme of health-related medicine.
2. To understand the basics of exercise, nutrition, and psychology.
3. To understand behavioral medicine focusing on cognitive behavioral therapy.
4. To set a research topic and understand the necessary theory and previously published data.
5. To be able to perform statistical analysis based on experimental data.
6. To be able to present research content appropriately.

Associate Professor
Toshiaki Nakano

Research Field : Medical Informatics (Department : University Information Center)

【Research Fields】
The main research themes in the Medical Informatics Department are cooperation among facilities in clinical information exchange, structured and unstructured clinical data processing, and improvement in rationalization and availability of clinical information infrastructure. We also participate in a research project that integrates various fields related to these themes.
While researching the effective use of accumulated medical records, including electronic medical record systems, we are also investigating the processing of structured data. Moreover, our research also examines the diagnostic support and learning support systems using the diagnostic imaging knowledge base based on semantic web technology. In addition to medical support resistant to system failures and disasters, as well as networks (wired and wireless) for connecting to various off-campus clinical information databases, we are investigating the construction and operation of information infrastructure, including power supply and system virtualization, as well as the utilization of information resources using smart devices under these infrastructures.

【Research Goals】
1. To explain the significance and issues of medical information systems, including clinical information systems, based on the results of analysis of the current situation.
2. To understand the needs of medical information systems.
3. To explain the skills and knowledge necessary for setting, constructing, and evaluating medical information systems, as well as their problems and issues.
4. To formulate, prepare, execute, and evaluate research plans in areas like standardization of clinical information, reformation of information infrastructure, and application of natural language processing to medical care.
5. To play a role in the development of medical information technology as a researcher or engineer in a way that impacts society at large.

Professor
Etsuyo Nishigaki

Research Field: Medical Behavioral Science (Department: Psychology)

【Research Fields】
Our research focuses on health and clinical psychology; specifically, the modification of health behaviors utilizing coaching psychology, psychological and physiological changes by practicing mindfulness, focusing, and the creation of stress management programs using various information and communication technology (ICT). Our graduate students are expected to pursue their research actively and independently regardless of these themes.

For undergraduate education, our professors and part-time lecturers, are in charge of subjects such as psychology, behavioral sciences, counseling and coaching, and mindfulness training, as well as courses at the Faculties of Nursing and Rehabilitation.

【Research Goals】
1. To be able to understand the main concepts of health, clinical, and coaching psychology.
2. To learn questionnaire survey methods, psychological experimental methods, and psychological interview techniques.
3. To practice medical coaching.
4. To perform and interpret the psychological tests necessary for research.
5. To perform statistical analysis appropriately based on research data.
6. To present research results at international conferences.
7. To summarize research results and publish them as academic papers.

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

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

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Published in December 2022