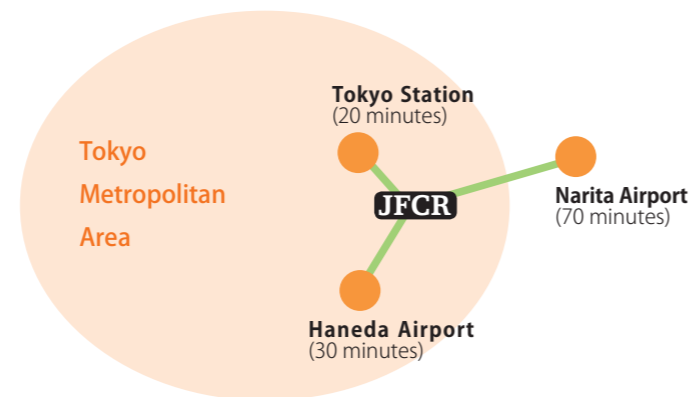


The Japanese calligraphy on the front cover reads *Gan-ken*, a familiar, short name for *Gan-kenkyukai* (Japanese for Japanese Foundation for Cancer Research). It was painted with a brush by Mr. Manabu Ozaki, a master of calligraphy.



# Japanese Foundation for Cancer Research



Japanese  
Foundation for  
Cancer  
Research

Cancer Institute  
Cancer Institute Hospital  
Cancer Chemotherapy Center  
Genome Center

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# Holistic Cancer Treatment and State-of-the-Art Research to Serve People around the World

Founded about 100 years ago, the Japanese Foundation for Cancer Research (JFCR) is the largest medical organization for cancer care in Japan. The Foundation mainly consists of the Cancer Institute, which provides basic research, the Cancer Institute Hospital, which offers a patient-centered multi-disciplinary approach, the Cancer Chemotherapy Center, which specializes in research on anti-cancer drugs, and the Genome Center, which conducts genetic research. Since the Institute, the Hospital, and the centers share the same building, JFCR staff can collaborate closely to deliver holistic cancer care and conduct state-of-the-art research.

To Improve the Well-being of People Everywhere by Achieving Better Cancer Control

## Mission

# JFCR Ethos

## Core Values

Creativity  
Innovation  
Quality  
Sincerity  
Cooperation

## Vision

To Become a World-leading Hospital and Institute for Cancer Diagnosis, Treatment, and Research

## Japan's frontrunner in cancer care and research for more than a century



JFCR was founded in 1908 as the first cancer-specializing organization in Japan. Under its basic principle, "To Improve the Well-being of People Everywhere by Achieving Better Cancer Control," JFCR established its research institute and hospital in 1934 to conduct wide-ranging cancer studies. Since then, JFCR has been playing a proactive role in cancer care and research in Japan, as is shown in JFCR milestones ranging from the understanding of molecular mechanisms of cancer onset to the development of innovative diagnostic and therapeutic methods. As a cancer-specializing medical organization accommodating both a research institute and a hospital, JFCR strives to achieve cancer control while maintaining its high vision and independence as an organization.

## Japan's largest hospital specializing in cancer care



The Cancer Institute Hospital has 700 beds, and in fiscal 2014 it treated 62,564 outpatients and 10,430 inpatients. With more than 7,000 surgeries performed annually, the Hospital is proud to conduct the largest number of cancer surgeries in Japan, especially those for stomach, breast, and colon cancers.

The Hospital's Ambulatory Treatment Center is also known as one of the largest outpatient chemotherapy facility in Japan. Moreover, in radiation therapy, the Hospital offers very accurate and low-invasive treatment, such as intensity-modulated radiation therapy (IMRT), by making use of the highest-quality equipment and technology. A team of oncologists at the Hospital specializes in treating various cancers, including advanced cancer, specific rare cancers, and refractory cancer, and provides patients with individualized cancer care that best fits each patient.

## Acclaimed globally for cancer research accomplishments



JFCR has always been a pioneer in basic cancer research, not only in Japan but also on a global basis. The Cancer Institute, which has been playing the main role in JFCR research, started working on genetic recombination in the 1970s and led the world by succeeding in cloning the interferon gene. With further achievements, including isolation of the human T-cell leukemia virus type 1 (HTLV-1), identification of anti-cancer drug resistance genes, and clarification of mechanisms of human cancer development, the Institute has attracted the world's attention and was listed as one of the world's leading cancer research institutes in *Science* magazine in 1992.

Alongside the Institute, JFCR's Cancer Institute Hospital, Cancer Chemotherapy Center, and Genome Center promote integrated cancer research, from basic scientific investigation to clinical applications.



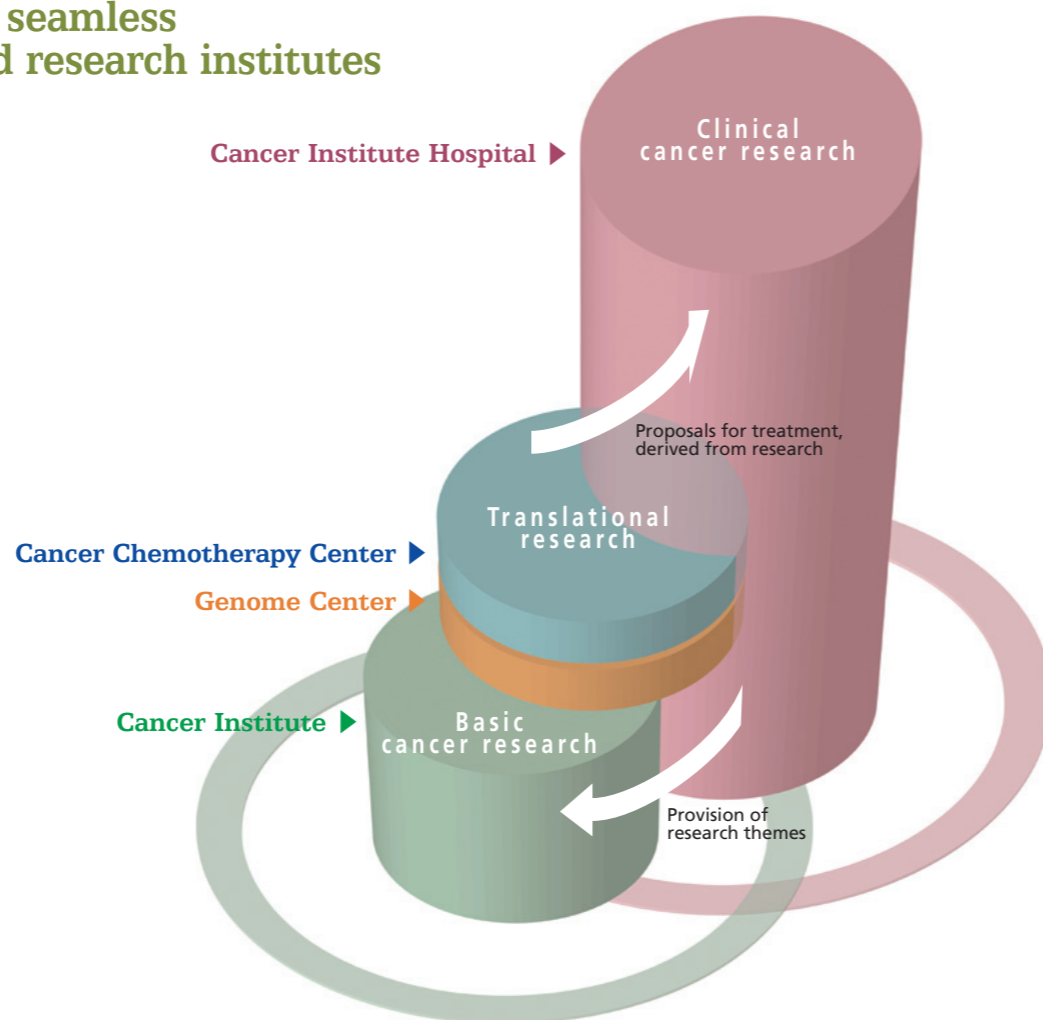
## Unique organization with seamless integration of hospital and research institutes

One of the outstanding characteristics of JFCR is close collaboration between the Hospital and the Institute. New therapeutic methods developed by the Institute are proposed for use in clinical settings at the Hospital.

Subsequently, the information obtained in clinical practice is sent as feedback to the research sections. To promote such mutual feedback effectively, the Hospital and the Institute share the same building. Notably, the Institute's Pathology Division, which operates together with the Hospital's Clinicopathology Center, is located on the same floor as the Hospital's operating rooms so that frozen section diagnosis can be smoothly performed during surgery.

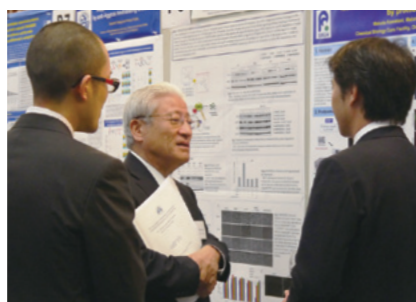
Moreover, the Cancer Chemotherapy Center and the Genome Center, which conduct anti-cancer drugs and genetic research, respectively, play roles in providing translational-type research between the Hospital and the Institute.

JFCR can simultaneously provide state-of-the-art medical care and high-level research throughout the continuum of basic research, translational research, and clinical practice.



## Fostering medical doctors and researchers specializing in cancer

JFCR also excels in the field of human resource development. From the establishment of the Hospital and Institute, JFCR has trained a large number of physicians and researchers involved in cancer control. Many of those who studied at JFCR have been taking initiative roles in cancer treatment and research at hospitals, universities, and research institutions on a global scale.



## Promotion of international exchanges to achieve better cancer control

As there are no borders or boundaries in the world of cancer, there is an urgent universal need to achieve cancer control. JFCR is expanding the circle of its activities, not only in Japan but also in other countries.

### Involvement in UICC activities for many years

JFCR has been involved in activities of the Union for International Cancer Control (UICC), a worldwide organization to eliminate cancer, since the early days of UICC's establishment in 1935. Also, the Foundation has been contributing to the promotion of global cancer research and prevention through its participation in the UICC World Cancer Congress and efforts to maintain the UICC Yamagiwa-Yosida International Fellowship. The current UICC membership comprises 770 organizations in 155 countries. The office of the Japan National Committee for UICC (UICC-Japan) is located in JFCR.

### Convening of Annual JFCR-International Symposium on Cancer Chemotherapy

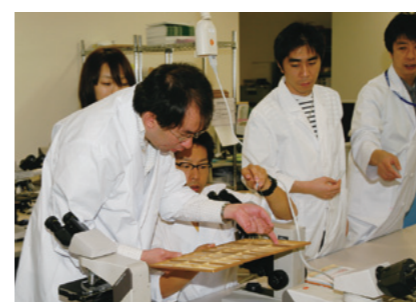
The JFCR-International Symposium on Cancer Chemotherapy (JFCR-ISCC) is an annual international conference held in Tokyo and organized by the Cancer Chemotherapy Center of JFCR, which has been playing a central role since the first symposium in 1996. The purpose of JFCR-ISCC is to share information regarding the conduct of research toward developing efficient anti-cancer drugs.

Every year, the symposium attracts approximately 200 participants, including researchers and clinicians from the West, Japanese medical institutions and universities, and pharmaceutical companies. The symposium is an important venue for the global cancer research community to engage in active discussion.



### Alliances with cancer care and research organizations overseas

In alliance with outstanding cancer care and research organizations overseas, JFCR is actively engaged in information sharing, research exchange programs, and business collaboration. JFCR has a partnership with Peking University Shenzhen Hospital (China), and Massachusetts General Hospital Cancer Center (USA). For Peking University Shenzhen Hospital, JFCR accepts trainees every year, and provides tele-pathology consultation service, in which our pathologists with the specialized knowledge and experience offer the consultations on the difficult cases.





# Cancer Institute Hospital

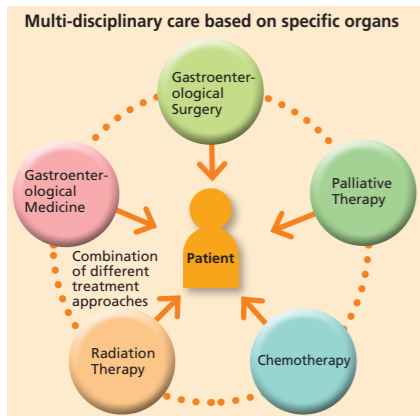
Aiming to be the ideal hospital and torchbearer for the future

## Supporting patients with high quality, holistic care



The Cancer Institute Hospital is the largest hospital specializing in cancer treatment in Japan and leads the nation in surgery, chemotherapy, and radiation therapy. The Hospital provides optimal treatment for various types of cancer, including refractory cancers, using state-of-the-art technology as well as the advanced skills and expertise of our specialists. Our basic concept of care is not only to treat cancer itself, but to deliver holistic health care by approaching the patient as a total person, offering comprehensive treatment while giving top priority to each patient's quality of life.

## Multi-disciplinary cancer treatment focusing on each patient



Our core policy at the Cancer Institute Hospital is to provide multi-disciplinary care. The Hospital was the first in Japan to adopt the multi-disciplinary approach to cancer treatment. The care of individual patients is discussed by the Cancer Board, a collaborative meeting of our cancer specialists including surgeons, medical oncologists, radiation oncologists, pathologists, nurses, pharmacists, and nutritionists. The aim of the Cancer Board is to draw upon the expertise and experience of specialists to provide the best possible treatment for each patient, while preventing medical error and avoiding unnecessary interventions.

## Creation of next-generation cancer care through close collaboration with research institute

The Hospital has been able to deliver high-quality cancer care through close collaboration with JFCR's research sections. For example, the Hospital's Medical Oncology Department collaborates with the Cancer Chemotherapy Center and participates in clinical trials of new anti-cancer drugs. With such strong partnerships between clinical and research units, the Hospital can create next-generation cancer care by developing new approaches to cancer diagnosis and treatment that are highly effective, safe, and minimally invasive.

*‘With its high technology, expertise and multi-disciplinary treatment unique to a specialized hospital, we strive to provide our patients with highly advanced and holistic cancer care.’*

**Toshiharu Yamaguchi, M.D., Ph.D.**  
Hospital Director



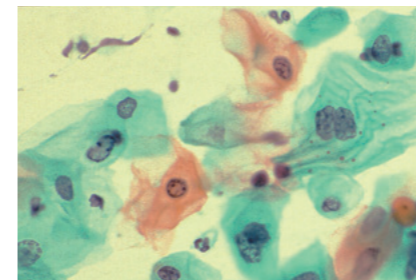
## Examination and Diagnosis

Experienced specialists using state-of-the-art equipment: the Cancer Institute Hospital provides careful examination, early detection, and accurate diagnosis of cancer.



### Clinical and genetic diagnosis

The Cancer Institute Hospital performs sophisticated diagnostic tests, conducted by a team of experienced and knowledgeable specialists and highly skilled technologists. Together, they focus on providing patients with safe, timely, and low-invasive tests. As well, the Hospital performs genetic diagnosis for personalized medicine, allowing each patient the opportunity to receive the optimal treatment for their cancer.



### Rapid pathological diagnosis performed simultaneously during surgery

With more leading pathologists than any other hospital in Japan, JFCR has acquired a good reputation for its prompt and precise diagnosis. The Clinicopathology Center staff perform pathological and cytological examination of specimens delivered from the operating room or examining room, and quickly determine whether there are any cancer cells in the tissue sample. Taking advantage of the resources and valuable experience gained by specializing in cancer care, the Cancer Institute Hospital has conducted the largest number of intraoperative frozen-section diagnoses in Japan. Moreover, the Hospital has been providing training for technologists since the Cytotechnologist School was established in 1968.

## Heartfelt, Skillful Nursing Care

At the Cancer Institute Hospital, nurses care and support patients with both warmhearted attention and skillful nursing expertise.

### Nurses with certificates for specialization in cancer care

The Hospital's staff of approximately 700 nurses is characterized by its large number of specialists in cancer nursing. The majority of the nursing staff is certified by the Japanese Nursing Association in a broad range of fields, including surgical nursing, cancer chemotherapy nursing, radiation oncology nursing, palliative care nursing, and breast cancer nursing.

*‘We practice considerate, careful nursing with high expertise in cancer care and attention to comfort, encouraging patients to draw upon their zest for living.’*

**Takako Shimizu, R.N.**  
Junior Hospital Director  
Department Director of Nursing



### Cancer Screening Center

The Cancer Screening Center collaborates with the Cancer Institute Hospital to provide thorough services ranging from medical checkup to treatment. If a medical examinee is diagnosed with cancer, the examinee will be immediately referred to a specific oncology department of the Hospital for further examinations and advanced medical care.

### International Patient Service

The cancer treatment offered by the Cancer Institute Hospital is not just for Japanese patients. People seeking superior cancer treatment come to the Hospital from all over the world. The International Patient Service Team provides support so that patients can smoothly receive high-quality treatment without language or cultural barriers.



# Treatment

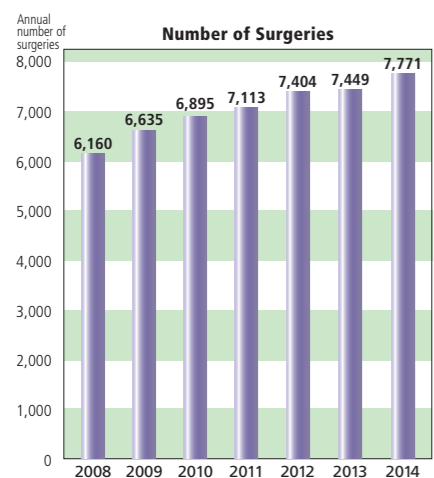
The Cancer Institute Hospital offers the latest and highest level of care by experienced specialists using state-of-the-art technology in each field of cancer treatment including surgery, chemotherapy, and radiation therapy.



## Surgery

### The most surgeries performed in Japan

At the Cancer Institute Hospital, the number of surgical procedures performed has increased every year and reached over 7,500 cases in fiscal 2014. The Hospital performs the highest volume of surgeries among Japanese hospitals for many types of cancer including stomach, colon, cervical, and breast cancer. The Hospital has accomplished this by bringing together an operating room team of oncology experts including surgeons, anesthesiologists, medical technicians, nurses, and others to provide high-quality surgical care for patients.



### Leaders in minimally-invasive surgery

The Hospital promotes minimally-invasive surgery, which helps patients by decreasing postoperative pain and allowing speedy recovery. Laparoscopy and Endoscopy Cooperative Surgery (LECS) is a surgical procedure developed by surgeons at the Hospital to resect tumors by simultaneously taking advantage of laparoscopic and endoscopic surgeries. In addition, the Hospital performs endoscopic submucosal dissection (ESD), a technique for the resection of tumors using an IT knife as well as robotic surgery with da Vinci surgical system. Combining skilled surgical technique with advances in technology, the Cancer Institute Hospital will continue to lead in the use of minimally-invasive surgery.



*‘A high number of surgeries provides opportunities for doctors to advance their technical skills, resulting in a broad range of enhancements to the quality of medical care provided by the Hospital.’*

**Takeshi Sano, M.D., Ph.D.**

Deputy Hospital Director  
Center Chief of Gastroenterology Center

### Breast cancer surgery for cure and cosmetic results

At the Cancer Institute Hospital, over 1,000 breast cancer surgeries are carried out every year—more than any other hospital in Japan. By taking advantage of accurate preoperative diagnosis, the Hospital performs breast-conserving surgery, a procedure where cancerous tissue is precisely and meticulously removed while minimizing the portion of breast removed. For patients undergoing mastectomy, all efforts at the Hospital are focused on patients’ quality of life. With close collaboration between oncology surgeons and plastic surgeons, we perform a large number of breast reconstruction surgeries to give patients the best chance for cure and satisfactory cosmetic results.



## Chemotherapy

### Outstanding treatment effects with chemotherapy

Recently, groundbreaking anti-cancer drugs have been developed, including molecularly-targeted drugs, dramatically expanding the treatment options available for patients. The Cancer Institute Hospital works in close collaboration with the Cancer Chemotherapy Center, where new anti-cancer drugs are under study. Research at the Cancer Chemotherapy Center is currently focused on such areas as cancer metastasis, drug-resistant cancers, and stem-cell therapy.

In addition, the Cancer Institute Hospital is now conducting a clinical study to improve overall survival in patients using multiple-drug chemotherapy. Another clinical study at the Hospital is underway to test a new chemotherapeutic method on advanced-cancer patients who have shown poor response to existing chemotherapy regimens. It represents a novel approach toward developing the next generation of chemotherapy.



*‘Treatment with anti-cancer drugs requires a long-term regimen to achieve the most effective treatment and to reduce adverse drug reactions. For that purpose, doctors, nurses, and pharmacists work as a team to provide treatment.’*

**Shunji Takahashi, M.D.**

Department Director of Medical Oncology



### One of the largest ambulatory chemotherapy center in Japan

Due to improvements in chemotherapy, cancer treatment has shifted from inpatient to outpatient settings. The Ambulatory Treatment Center (ATC), the outpatient chemotherapy center of the Hospital, is one of the largest in Japan. The ATC features reclining chairs and TVs in a relaxed and comfortable atmosphere that allows patients to maintain a normal social life while receiving their chemotherapy.





## Radiation Therapy

### Revolutionary advances in radiation therapy

In recent years, remarkable progress has been made in the technology and techniques used in radiation therapy. The Cancer Institute Hospital offers highly accurate radiotherapy, such as stereotactic body radiation therapy (SBRT), intensity-modulated radiation therapy (IMRT), volumetric-modulated arc therapy (VMAT), and image-guided radiation therapy (IGRT). SBRT is highly effective for treating early-stage non-small cell lung cancer by precisely delivering high doses of radiation. IMRT is a radiation technique that conforms the radiation field to the exact shape of the tumor, and is used to treat prostate, head and neck, and gynecological cancers. The radiation technologies at the Hospital make it possible to deliver higher doses of radiation to target lesions without damaging adjacent normal tissue.



*“Radiation oncology specialists work as a team to provide highly accurate, safe, and curative radiation therapy with minimal radiation-related toxicities. We conduct personalized radiation therapy in treating 1,700 cases a year to achieve each patient’s cure goal.”*

**Masahiko Oguchi, M.D., Ph.D.**  
Department Director of Radiation Oncology

### Radiation oncology team treats tumors through integrated efforts

In the Hospital, specialists offer cancer care as a dedicated radiation therapy team. Radiation oncologists accurately determine the main lesion and the extension of the cancer and work closely with medical physicists and radiotherapy technologists to create the treatment plan. Radiotherapy technologists operate the radiotherapy units, quality control specialists check on safety management, certificated nurses specialize in daily patient care, and medical clerks work on schedule management. In addition, the radiation therapy team provides educational training to other institutional medical staff, thereby contributing to improvements in radiation therapy in Japan.

### Intensive safety checking system in radiation therapy

To deliver safer and more-accurate treatment, the Radiation Oncology Department has developed a Radiation Oncology Information System in collaboration with system engineers. Linking patient information directly to radiotherapy devices, this system prevents excessive or unnecessary irradiation of patients. By cross-checking updated patient data, which is entered by various specialists, with regimen details stored in the radiotherapy units, the system immediately stops irradiation when there is any inconsistency between patient information and regimen details.



## Palliative Therapy

The Cancer Institute Hospital also focuses on providing palliative therapy (palliative oncology). We treat and support physical, psychological, social and spiritual pain associated with cancer, so as to maintain and improve the quality of life (QOL) of both inpatients and outpatients.



### Palliative oncology team supports QOL of patients

Cancer patients need to be treated in a holistic manner because they experience not only cancer-related suffering, but also anti-cancer treatment-related side effects. To deal with these challenges, the Hospital established, in 2005, the Palliative Care Department (now developed to Palliative Care Center), and subsequently launched the Palliative Care Team in 2009. This department comprises palliative care physicians, medical oncologists, psycho-oncologists, nurses who specialize in oncology nursing, and pharmacists who observe drug-related side effects. We serve patients in the palliative care unit and the general ward, as well as outpatients, with palliative care for physical and mental concerns in collaboration with patients’ attending doctors and nurses in each department.



*“We believe palliative oncology, which mainly treats physical and psychological pain, is the fourth independent cancer therapy in addition to surgery, chemotherapy, and radiation therapy, and it should be provided from onset of illness and/or initial diagnosis.”*

**Masaru Narabayashi, M.D., Ph.D.**  
Department Director of Palliative Therapy

### Palliative treatment staff foster patients’ zest for life and support patients’ dignity

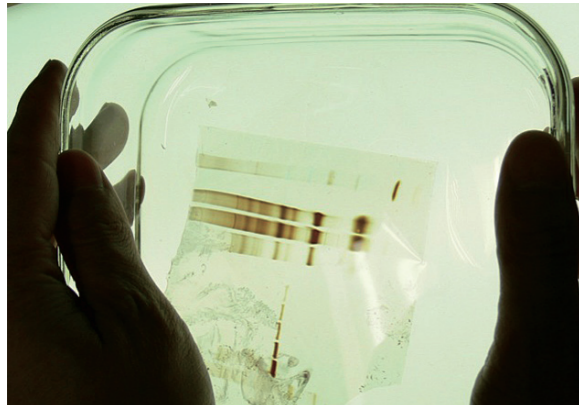
At our Hospital, palliative therapy is not considered to be “old-style terminal care.” We, therefore, changed the name of the Palliative Care Department to Palliative Therapy (Palliative Oncology). Furthermore, palliative therapy specialists provide medical treatment by giving the highest priority to QOL of both patients and their families. Located on the top floor of the Hospital with a wonderful view of Tokyo Bay, the palliative therapy unit has 25 beds in private rooms where patients can peacefully lead their daily lives in a calming and reliable environment. Upon receiving the highest level of patient support, palliative therapy and care under this initiative, many patients recover their zest for life and dignity.





# Cancer Institute

Contributing to the development of innovative cancer treatment through basic research



To fulfill the mission of the Japanese Foundation for Cancer Research, "promotion of the human welfare by elimination of cancer," Cancer Institute scientists conduct basic research to discover mechanisms of cancer development and progression and to develop novel therapies. In collaboration with the Cancer Institute Hospital, clinical research scientists discover novel molecular events in human cancer and develop new diagnostic devices. Scientists in all fields share common interests in cancer research and translate their fundamental findings to development of novel therapeutic tools for use in the near future.

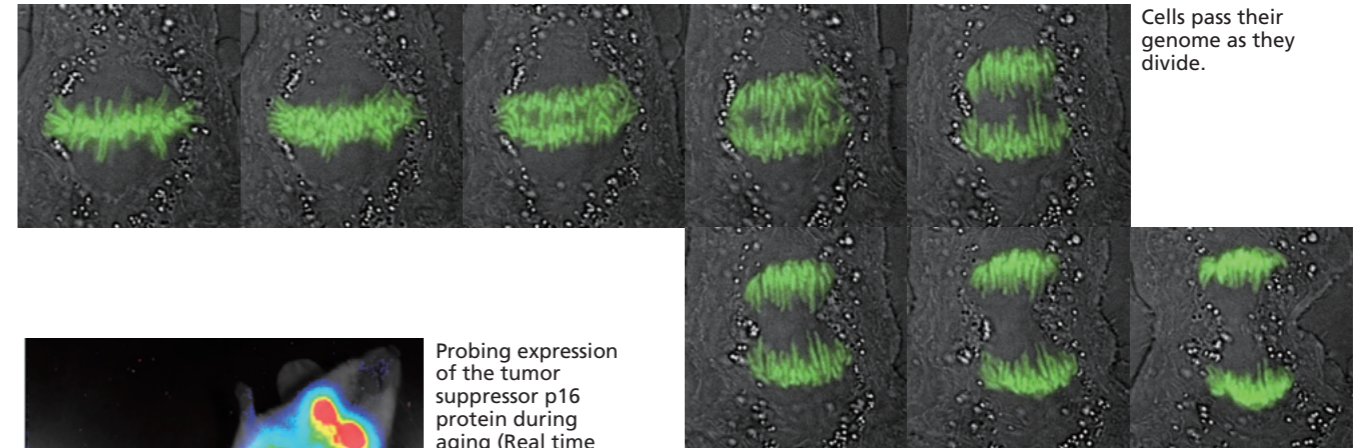
Our researchers have made epoch-making achievements since the Cancer Institute opened as Japan's first cancer research institute in 1934. Such work includes cloning of interferon and interleukin-2 genes by Dr. T. Taniguchi and colleagues and identification of the familial adenomatous polyposis gene, APC, by Dr. Y. Nakamura and colleagues. These discoveries gave invaluable contribution to life science and clinical medicine and benefit patients of cancer as well as of non-neoplastic disorders.

The Cancer Institute is home to 12 laboratories and 100 faculty and staff members. Today, we are making continuous efforts for fundamental cancer research of the next generation as well as innovative treatment. Part of the studies is achieved in vitro to gain new insights into abnormal cell division and chromosome function in cancer. Studies using animal models provide important breakthroughs on the relationship between cellular senescence and cancer development. The discovery of novel fusion genes in lung cancer will lead to a cancer cure.

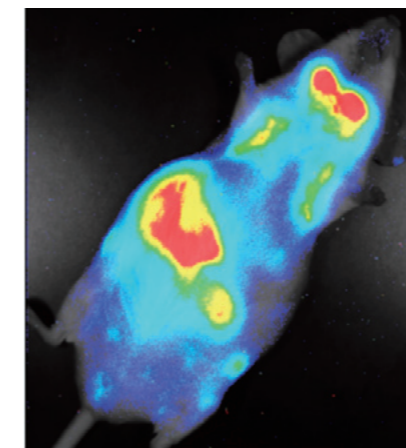
As an academic and research institution, the Cancer Institute promotes scientific support programs for cancer research in Japan and collaborates with a number of other institutions around the world to enable the sharing of information and use of medical resources.

*It is important for cancer control to rapidly feed back the results of basic research. By soundly balancing basic research, translational research, and clinical research, we can promptly provide updated cancer treatment to patients.*

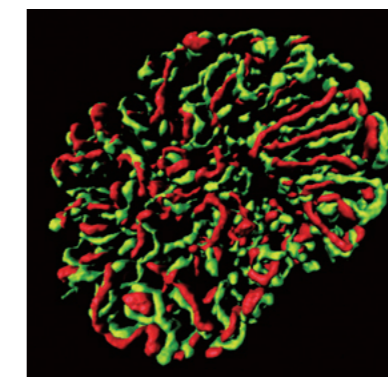
**Tetsuo Noda, M.D., Ph.D.**  
Institute Director



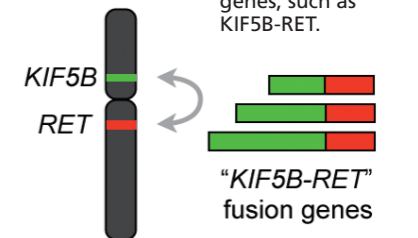
Cells pass their genome as they divide.



Probing expression of the tumor suppressor p16 protein during aging (Real time imaging analysis of live animals).



Setting the stage for chromosome segregation in prophase nuclei (Sister chromatids are labeled differentially by green and red fluorophores).



## Research Projects

### ● Division of Pathology

Together with the clinical departments in the Cancer Institute Hospital, we aim to improve our diagnostic expertise to indicate the best chemotherapy and/or radiotherapy protocols through a collaboration called the Ganken Genome Project. We are also trying to predict malignant potential by using histological, molecular-biological, and genomic methods as well as long-term follow-up studies of precancerous lesions and early stage cancers.

### ● Division of Cell Biology

Genetic alteration is one of the major causes of cancer development, and growing numbers of mutations in oncogenes and tumor suppressor genes have been identified. We explore the functions of these genes using genetically modified mice as well as in vitro. Mice bearing gene mutations can be used as animal models for human cancer and thus enable us to evaluate the potential of chemotherapeutic agents.

### ● Division of Experimental Pathology

Loss or gain of chromosomes is associated with many cancer cells. We aim to understand how chromosomes condense, achieve bipolar spindle attachments, and how cohesion is subsequently dissolved to allow sister chromatid separation. Elucidating these processes should provide an insight into the mechanisms underlying chromosome instability in cancer cells.

### ● Division of Cancer Biology

It has emerged that cellular senescence serves as a safeguard that prevents inappropriate cell proliferation. Our research goal is to understand the signaling pathways that induce cellular senescence in vivo and to elucidate how these pathways are perturbed in cancer cells.



# Cancer Chemotherapy Center

Innovating effective and risk-free anti-cancer drugs and treatments

## ● Division of Carcinogenesis

To understand the cell of origin in cancer and the molecular mechanism of multi-step carcinogenic processes, we focus on oncogenic transcription factors in hematological and mesenchymal malignancies. We use the genetically engineered and/or ex vivo mouse models in order to identify novel disease genes and pathological genetic pathways that lead cells to cancer.

## ● Division of Protein Engineering

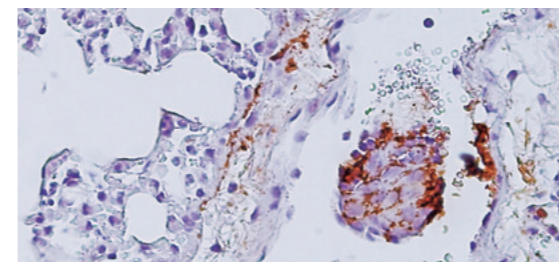
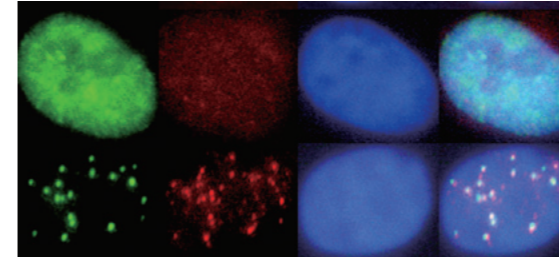
We aim to develop artificial protein-based biomaterials for drug delivery systems and diagnostic devices. To achieve this, we use our proprietary technology named MolCraft, which is a novel type of in vitro protein evolution system based on a hierarchical approach.

## ● Division of Cancer Genomics

To establish personalized medicine, we conduct a comprehensive study of cancer genomics using next generation sequencers, microarray, or mass spectrograph in collaboration with the Genome Center. Our goal is to examine cancer genomics, and to develop a prediction system of drug effectiveness and side-effects and bioinformatics methods for drug discovery.

## ● Pathology Project for Molecular Targets

To establish novel conceptual bases for cancer diagnosis and treatment, we have developed a histomolecular pathological approach to explore solid cancers for novel fusion genes. We have identified 16 fusion kinases including ALK, ROS1, and RET fusions, leading to development of novel therapeutics using specific kinase inhibitors.



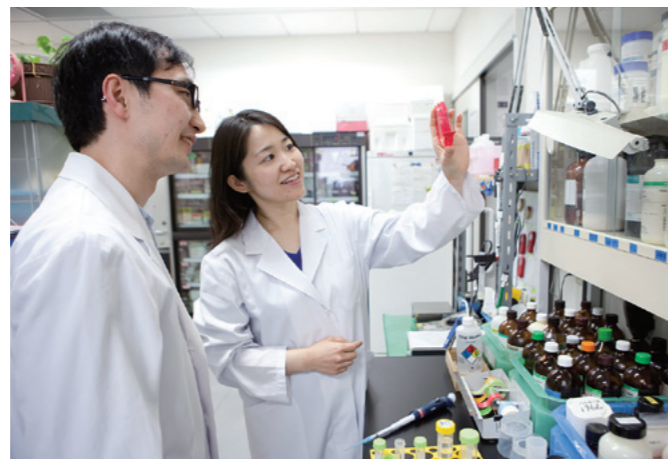
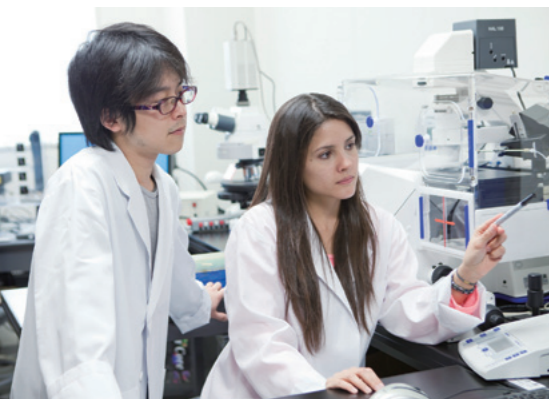
“Cure of cancer with drugs” is the final goal of our challenging research. Toward this end, our research projects are currently focused on areas of metastasis, acquired drug-resistance, tumor heterogeneity, and stem-like properties of cancer cells.

Cancer cells carry various abnormalities in multiple genes and are thereby driven to unlimited growth. Recent strategy for “molecular targeted drugs,” which are innovative anti-cancer drugs, involves finding gene abnormalities which are critical for cancer cells followed by developing drugs that overcome the abnormalities. This strategy has been used for successfully developing new anti-cancer drugs in recent years. The efficacy of the drugs on patients, however, is limited. We are therefore currently challenging to solve those issues through developing molecular targeting therapy, practically focusing on the prevention of cancer cell metastasis, mechanistic understanding of acquired drug-resistance and tumor heterogeneity in patients, and characterization of cancer stem cells particularly in relation to the responsible genes and telomere properties of cancer cells.

The Cancer Chemotherapy Center was established in 1973 and has been playing a central role in promotion of cancer chemotherapy in Japan. We continue efforts on 1) Drug-screening service with cancer cell panel, 2) Organizing annually the JFCR-International Symposium on Cancer Chemotherapy, 3) Holding periodical meetings of the Anti-tumor Drug Development Forum, and 4) Supporting the secretariat activity for the Japanese Association for Molecular Target Therapy of Cancer.

*“The Cancer Chemotherapy Center performs translational research to cure cancer with drugs. We continue to undertake our translational research to link basic research and clinical research as a private, non-governmental medical organization.”*

**Naoya Fujita, Ph.D.**  
Center Director





# Genome Center

Realizing precision cancer medicine based on multi-omics information



In addition to our solid basic research, the Cancer Chemotherapy Center focuses on “Translational Research (TR)” and “reverse TR” to apply research findings to clinical practice and to obtain new knowledge from clinical cancer specimens by collaborating with physicians, pathologists, and basic researchers under IRB approval. To apply the findings for better future cancer therapy, we are developing anti-metastasis drugs (neutralizing antibody and low-molecular-weight compounds) targeting Aggrus protein discovered in basic research. We are also developing compounds called G-quadruplex ligands, which can target patient-derived glioma stem cells.

Recently, various novel molecular targeting agents have been developed for cancer chemotherapy. However, resistance in treatment-naïve cancer or acquired resistance is a life-threatening problem for cancer patients. We thus examine the residual tumor specimen for understanding molecular mechanisms of resistance against molecular targeted therapy, and the characteristics of cancer stem-like cells (CSCs).

## Research Projects

### ● Division of Experimental Chemotherapy

Analysis of acquired drug resistance and tumor metastasis

### ● Division of Molecular Pharmacology

Discovery and development of novel molecular-targeted anti-cancer drugs

### ● Division of Molecular Biotherapy

Telomeres, cell immortality and cancer stemness as therapeutic targets

### ● Division of Genome Research

Genome science-driven research for targeted therapy

### ● Division of Clinical Chemotherapy

Analysis of drug resistance and molecular target by imaging technology

The aim of this research division is to identify possible targets, to clarify their function, and ultimately to develop an effective molecular-targeted therapy for cancer. For this purpose, we are investigating the molecular mechanisms of acquired resistance and developing anti-metastatic drugs targeting our identified Aggrus/podoplanin protein.

Our mission is to contribute to cancer chemotherapy by creating new molecular-targeted drugs. To this end, we established a panel of cancer cell lines (JFCR39) and an accompanying database, which helps us to identify anti-cancer compounds and their molecular targets. Actually, ZSTK474, a PI3K inhibitor, has been evaluated in clinical trials.

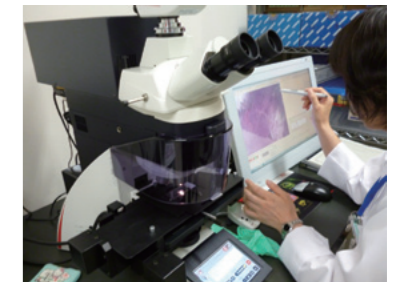
Unusual maintenance of chromosome ends, telomeres, supports infinite cancer cell growth. This system will also support so-called cancer stem cells, which contribute to initiation, metastasis, and recurrence of the disease. This laboratory investigates the molecular mechanisms for telomere maintenance and cancer stemness, and develops druggable seeds for eradication of cancer.

Our research interests are to identify new molecular targets for tumor-selective therapy and to identify biomarkers for predicting drug responsiveness in cancer patients. Using genome technologies, we promote two projects: 1) basic research for microenvironment-oriented, molecular-targeted therapy, and 2) translational research for diagnosis of drug responsiveness in molecular-targeted therapy.

The molecular targeting drugs, imatinib (ABL-kinase inhibitor), rituximab (anti-CD20), improved prognosis in leukemia and lymphoma. We investigated resistance mechanism using clinical samples under IRB approval. We discovered CD20 mutation, and up-regulated gene in leukemia after exposure of imatinib, proteasome inhibitor resistant myeloma cell line under investigation using GFP-ADCC.

A dominant characteristic of cancer is heterogeneity. For effective diagnostics and therapeutics, it is critical to develop methods to address the complexity of cancer so as to categorize cancers into homogeneous subgroups, representing a common mechanism of the disease. Recent research has developed genome-wide approaches based on gene expression analysis, SNPs analysis, proteome analysis or sequencing technology. We develop methodologies to utilize these systematic and comprehensive genomic technologies toward realization of personalized medicine as well as toward understanding molecular mechanisms in metastasis, relapse, and drug resistance of intractable cancers.

The Genome Center of JFCR was installed in 2001 with the aim of advancing translational research to establish personalized cancer medicine, in close cooperation with the Cancer Chemotherapy Center and the Cancer Institute Hospital. From 2001 to 2006 the project for genome diversity operated and was involved in development of diagnostic methodologies to predict individual patient responses to conventional cytotoxic chemotherapeutics. The Genome Center subsequently commenced a project for achievement of personalized cancer medicine in 2003, a project for generation of therapeutic antibodies with novel function in 2006, a project for development of next-generation cancer medicine in 2011, a project for realization of personalized cancer medicine in 2013, and then recently a project for development of genomics-based cancer medicine in 2015. At present three on-going projects are actively producing substantial genomic data with links to clinical information.



## Research Projects

### ● Development of Genomics-based Cancer Medicine

Integrative genomics to develop model systems to establish cancer genomics-based medicine

### ● Development of Innovative Research on Cancer Therapeutics

Development of novel therapeutics for intractable cancers through identification of molecular targets by genomic profiling

### ● Realization of personalized cancer medicine

Assessment of individuality in cancer medicine based on genomic information

The aim of this project is to develop advanced cancer genomics-based medicine through endeavor to effectively provide genomic information to clinical settings by tight collaborations with the Cancer Institute Hospital, the biggest cancer hospital in Japan. Taking an advantage of substantial number of samples with high-quality clinical information derived from the Cancer Institute Hospital, we generate comprehensive genomic and epigenomic data to explore novel molecular targets and biomarkers. In conjunction with genome-wide high throughput data, we then construct experimental model systems by establishing patient-derived xenografts or cell lines. By these efforts useful tools are to be achieved toward development of the basis to realize “precision medicine” as a next-generation standard in clinical cancer practice.

The project involves research to develop novel diagnostics and therapeutics to treat intractable cancer patients with metastasis, relapse, and chemotherapy-resistance, based on molecular profiling of genomic information. Taking advantage of being able to rely on massively parallel sequencing technology, we sequence whole genome/exome/RNA derived from a cancer sample. The resultant genomic information is analyzed with bioinformatics and biostatistics, and then linked with clinical information so as to identify novel biomarkers and molecular targets toward personalized medicine for intractable cancers.

The project is aimed at realization of medical care that leads prevention, diagnosis, and treatment personalized to individuals relying on genetic information. In collaboration with the Cancer Institute Hospital, the Genome Center has been collecting over 3,840 blood samples from patients with 13 types of cancers, which have been publicly deposited at Biobank Japan in a nation-wide framework (<https://biobankjp.org/english/index.html>) accompanying with precise clinical information. The high-throughput genomic analysis of these samples can reveal diverse genetic variabilities, such as single nucleotide polymorphisms (SNPs), which strongly associate with incidence risk or drug susceptibility. The Genome Center also employs leading-edge proteomics technologies to develop early detection biomarkers, companion diagnostics, and neoantigen-based cancer immunotherapy.



# History



After World War II, Cancer Institute Hospital reopened in Central Tokyo

New modern-equipped hospital built in Tokyo



Cancer Chemotherapy Center established

Dr. T. Taniguchi of the Cancer Institute successfully isolated IFN-gene; a world's first

Dr. M. Yoshida of the Cancer Institute identified the molecular structure of HTLV-1, human leukemia virus

Dr. Y. Nakamura of the Cancer Institute elucidated colon cancer-causing gene, and named it APC gene



3,000 pneumectomy cases performed  
100th Year Anniversary Ceremony of JFCR

Ministry of Health, Labour, and Welfare designated JFCR as an advanced treatment hospital.

ISO 15189 certification obtained

**1908** Japanese Foundation for Cancer Research (JFCR) founded as a special cancer research organization (first Japanese organization specializing in cancer)

**1934** Research Institute and Hospital of JFCR established in Tokyo (29 beds)



**1946**

**1963**

**1966** Cancer Institute completed

**1968** General Hospital accreditation received



**1973**

**1979**

**1983**

**1990** 10,000 gastrectomy cases performed; a world's first

**1992** *Science*, the world's leading journal of scientific research, highly evaluated JFCR as one of the leading research institutes in the world.

**1995** Prince Hitachi Prize for Comparative Oncology established

**2001** Genome Center established

**2005** JFCR relocation to Tokyo Bay Area completed

**2008**



**2011**

**2015**

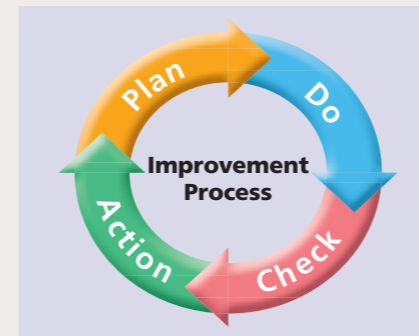
## Open Seminars



### Disseminating knowledge and enhancing cancer care

To inform and educate the public about cancer, JFCR organizes or co-organizes open seminars several times a year. In addition, for medical professionals and researchers studying cancer control, the Cancer Institute Hospital or each JFCR research institute holds workshops and open seminars, aiming to enhance cancer treatment skills and promote cancer research, not only at JFCR but also throughout Japan. Moreover, JFCR has been deeply involved in the activities of Japan's largest organization for cancer researchers, the Japanese Cancer Association, particularly in the establishment and management of the association. The *Japanese Journal of Cancer Research*, published by the association, is recognized as one of Japan's leading English-language academic journals.

## Kaizen Initiatives



### Operational reform involving all JFCR members

Since 2012, JFCR has been carrying out its operational reform as the only private medical institution specializing in cancer. To uphold its motto of "On-site-driven reform," all 1,700 JFCR members are involved in resolving various on-site issues in their daily operation through their own initiative. Each and every member makes effort to realize the continuous management stability and higher-quality of the medical care, which also results in creating workplaces that motivate them. With this *kaizen* (Japanese for improvement) activity, JFCR is accomplishing remarkable qualitative and quantitative results.

## Donation



### Contributions supporting JFCR activities

JFCR has always pursued the ideal environment for world-class treatment and research. As JFCR is a private organization, these activities are supported by donations from corporations and individuals who concur with JFCR's mission. Your valuable contribution will be used for the following purposes:

- Making significant advances in cancer therapies and research
- Installation of the advanced medical equipment and facilities
- Educational seminars to raise awareness of cancer and convey the importance of early detection and treatment



The symbol mark chosen for JFCR is the crab. In Greek, the word for crab is *karikonos*, which also means cancer, as the crab shape resembles a tumor. The pattern of the symbol is taken from the hand guard of a sword made by a Japanese master swordmaker around 1950. The original sword is owned by the Tokyo National Museum. Although JFCR is named *Gan-kenkyukai* in Japanese, people call it *Gan-ken* for short as a familiar nickname.