

## Location

The Center is located near JR Shin-Osaka Station, and it's accessible directly from the north side of JR Kishibe Station.

About 7 min. from JR Shin-Osaka Station  
Accessible directly via a walkway (about 100 m)  
from the ticket gate at Kishibe Station (above the train platforms)

Taking clinical science  
beyond the cutting edge



# Pursuing new treatments through our Hospital, Open Innovation Center, and a major regional

# Research Institute, medical cluster

## The Center is pursuing initiatives ranging from prevention to cutting-edge treatment and research at its new location.

The National Cerebral and Cardiovascular Center's new location, which opened in July 2019, brings the Hospital, Research Institute, and Open Innovation Center together under a single roof. We now have more operating and catheter rooms, including four hybrid operating rooms where surgical procedures and catheter treatment can be performed at the same time, as well as more cutting-edge equipment such as gamma knife and PET systems. The new facility also offers an extensive suite of research equipment, including one of Japan's largest animal laboratories.

One of the new location's most defining characteristics is the new Open Innovation Center (OIC), which is designed to foster collaborative research that goes beyond the Center to bring in a variety of partners such as research facilities operated by private-sector businesses and universities. We expect the OIC not only to develop cutting-edge medical devices, but also to communicate information about the prevention of diseases that will become more prevalent as Japan's

population ages, along with new findings with relevance for home nursing care, both of which will be key areas going forward.

The Center's relocation has transformed the area on the north side of JR Kishibe Station into a major medical cluster. Known formally as the Northern Osaka Health and Biomedical Innovation Town and popularly as "KENTO," the area is the largest and most unique of the clusters surrounding the six institutes that make up Japan's National Centers for Advanced and Specialized Medical Care and Research. With the opening of the Suita Municipal Hospital in December 2018, we gained the ability to pursue joint initiatives to address the needs of Japan's aging population. The cluster is also home to a nursing home, a park and gym designed to promote health, and even a restaurant that specializes in the Karushioh (low-salt) diet promoted by the NCVC. KENTO makes it possible for concerted, multi-partner programs in areas ranging from prevention to cutting-edge treatment and research, one of which includes the distribution of wearable monitors to people who live in nearby condominiums to collect blood pressure, pulse, and other data.

## Introducing an NCVC that's brand new, inside and out

The Basic Act on Measures to Address Stroke, Heart Disease, and Other Cardiovascular Diseases in Order to Lengthen Healthy Lifespans, which was enacted in December 2018, includes provisions that create a national patient registry. The leading role played by the national government has made it possible to register more patient cases than was possible in the past, and we've responded by putting in place structures to allow the NCVC to present more findings.

We also need to continue to pursue cutting-edge preventive initiatives. In addition to implementing preventive methods and intervention studies that take advantage of the findings of the Suita cohort study, which has been underway for more than 30 years, it will be important to study methods for treating cerebral and cardiovascular disease in cancer patients in partnership with the Suita Municipal Hospital. Such efforts reflect our commitment to an approach that explores and takes into account the interrelationships between the body's many systems. In addition to cardiorenal and other data generated internally at the NCVC, we are pursuing

research into new treatments for cerebral and cardiovascular disease in patients with familial hypercholesterolemia.

Advanced medicine demands a cutting-edge approach, so we will leverage our extensive track record, including such innovative methods as catheter-based treatment of mitral insufficiency, to establish safe techniques and promote them nationwide.

It will also be necessary to pursue partnerships with the Hospital, Research Institute, and OIC. The Research Institute has discovered a number of new cardiovascular regulatory peptides, and it will work closely with the Hospital going forward to develop new treatment techniques based on the extensive patient case data that the NCVC has accumulated. Dialogue between researchers and physicians will be an essential part of that process, which is why we created the Science Café at the OIC. We will utilize that space to generate new ideas through face-to-face interactions while creating opportunities for dialogue with stakeholders from numerous fields.

## Striving to become a model medical cluster through community-wide collaboration

Our goal is to transform the KENTO cluster into a model medical community. To accomplish that goal, we will need to build a successful treatment track record and establish systems for accommodating patients as quickly as possible. To that end, we will strengthen our already-robust partnerships with medical associations so that we can improve treatment results by having physicians refer patients to the NCVC immediately when necessary, and we will study how to build systems for offering life-saving treatment.

We are also eager to work with physicians in private practice to develop methods for preventing cerebral and cardiovascular disease. One example is an initiative to take preventive steps at the examination stage. We'll establish a process by which data from health check-ups can be shared and patients referred to the NCVC as necessary. Since the KENTO cluster is located in both Suita and Settsu, we'll expand the scope of the Suita cohort study to include residents of Settsu so that we can accumulate and analyze more patient case data as we work to generate new research findings for the prevention of cerebral and cardiovascular disease.



Hisao Ogawa  
President

National Cerebral and Cardiovascular Center

### Philosophy

We strive to promote the health and happiness of the people of Japan as part of the National Centers for Advanced and Specialized Medical Care and Research by elucidating and controlling cerebral and cardiovascular disease.

### Basic Policies

- We provide model, cutting-edge care for cerebral and cardiovascular disease.
- We offer safe, high-quality care based on a transparent and highly ethical approaches.
- Our Research Institute and Hospital work together closely to pursue cutting-edge research into cerebral and cardiovascular disease.
- We train a variety of specialists and leaders in cardiovascular care.
- We create workspaces that ensure pride and motivation on the part of all employees.

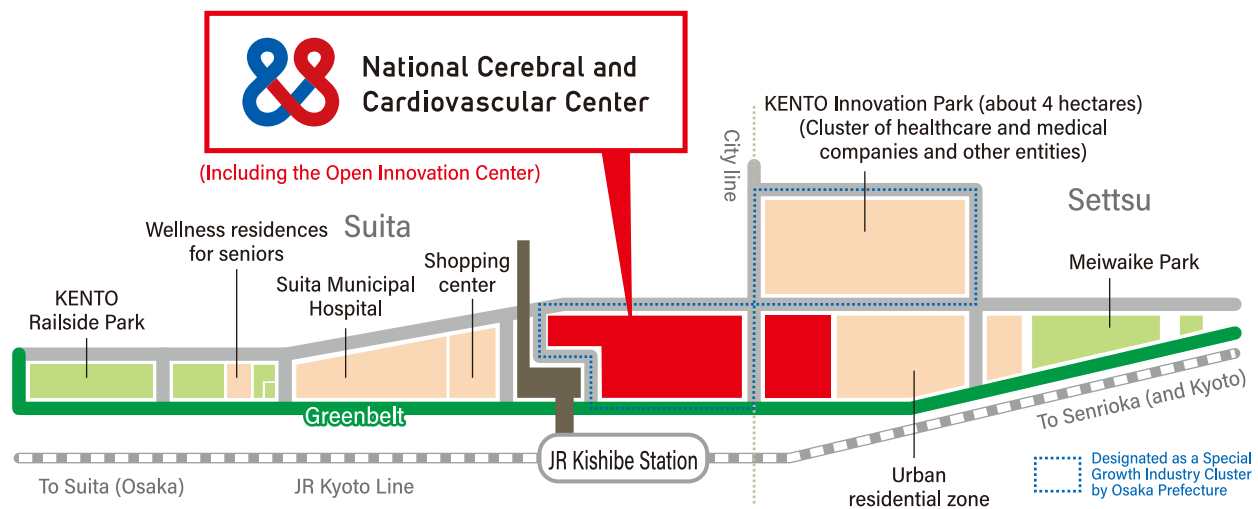




# Contributing to the community and its health as a member of the KENTO cluster

The Northern Osaka Health and Biomedical Innovation Town (known familiarly as "KENTO") is an area of about 30 hectares running east to west in Suita and Settsu.

Designed around the concept of health and medicine, it includes the NCVC as well as Suita Municipal Hospital, KENTO Railside Park, a shopping center (Vierra Kishibe KENTO), and wellness residences for seniors. Going forward, the NCVC will work through its Open Innovation Center to pursue a variety of partnership initiatives that the KENTO cluster makes uniquely possible in an effort to help transform the area into a model medical cluster that can play a leading role in the drive to lengthen healthy lifespan.



**Becoming a leading region in cerebral and cardiovascular disease prevention, treatment, and research**

**Profile of the NCVC**

Facility: 2 underground stories, 10 aboveground stories, and 2-story tower  
Site: 30,585.17 m<sup>2</sup>  
Building: 129,881.84 m<sup>2</sup>  
Beds: 550

Outpatient treatment: 700 to 800 per day  
Divisions: 28  
Parking: 304 vehicles



# The optimal treatments provided to all patients by teams of specialists of NCVC

NCVC's mission is to provide less invasive high quality treatment with by a team of closely collaborating experts.

## Introduction of Departments

### ■Department of Cardiovascular Medicine

#### ○Coronary Diseases

Diseases of coronary arteries, which supply nutrients to the heart, such as myocardial infarction and angina pectoris are treated by experts in this division. The division has one of the best acute phase survival rates in Japan.

#### ○Vascular Diseases

Catheter-based treatment for vascular diseases such as occlusive arteriosclerosis is provided. The division collaborates with the Division of Vascular Surgery as required.

#### ○Heart Failure

Wide ranging treatments, including drug therapy for heart failure and catheter-based treatments for valvular disorders and cardiomyopathy, are provided to patients from all over Japan. The division also has the first palliative care team in Japan specialized in advanced heart failure and cv diseases.

#### ○Arrhythmias

Various catheter-based treatments, including the balloon ablations, are possible. The number of device implantation is a top rank in Japan. We are also working with left atrial appendage closure devices.

#### ○Pulmonary Circulation

This division is among the few centers that specialize in pulmonary hypertension in Japan, and treats patients from all over the country. It is a world leader in balloon pulmonary angioplasty for chronic thromboembolic pulmonary hypertension.

### ■Department of Cardiovascular Surgery

#### ○Adult Cardiac Surgery

The team of adult cardiac surgery takes care of valvular heart disease, ischemic heart disease, heart failure and others. The treatments cover off pump coronary artery bypass grafting, minimally invasive cardiac surgery, robotic surgery, complex valve repair, transcatheter valve replacement including valve-in-valve technology, valve replacement with homografts, heart transplantation and implantation of mechanical circulatory system including left ventricular assist device.

#### ○Vascular Surgery

This division is always ready to deal with patients who require very emergency attention, such as those with acute aortic dissection, and has expertise in minimally invasive treatments for a wide range of cases. An exclusive outpatient section has also been set up for the treatment of varicose veins of the lower limbs.



## We are administrating prompt initial evaluation and treatments to improve the clinical outcomes in patients with cardiovascular diseases all year round.

The new hospital has seamless transition among emergency, radiology (CT, MRI section), echo laboratory, catheterization laboratory, and operation room, which provides optimal treatments for patients. We also have a high performance "Doctor Car" and new heliport to transfer the severely ill patients from other hospitals. The updated new hospital can provide the improved prognosis for patients with cardiovascular diseases. In addition, the Emergency Department was newly established on April 1, 2020.



## Very well-planned treatment for all patients including those with severe conditions

Emergency response for patients with severe conditions is also well-organized. For those with severe heart failure because of myocardial infarction, fulminant myocarditis, etc., we provide the latest treatments such as implantation of a ventricular assist device, which can directly assist the left ventricle with a small axial flow pump, inserted into the heart percutaneously through a subclavian artery or a femoral artery.

For patients suffering acute aortic dissection, we can offer wide range of treatments, such as hybrid surgery in which surgery and stenting are combined, as an optimal therapy.



## Minimally invasive treatment by the "Heart Team"

The heart team by cardiologists and cardiac surgeons give optimal treatment for each individual patient. Patients can select the option from surgery including robotic surgery and left ventricular assist device implantation, catheter-based therapy such as transcatheter valve replacement or clip device, hybrid therapy and so on. Because of the one heart team, patients can receive seamless treatment.



### Rapid percutaneous catheter-based treatment for cardiogenic shock

We proactively undertake percutaneous catheter-based treatment (Impella®, VA-ECMO) for patients with cardiogenic shock caused, for instance, by acute myocardial infarction, severe cardiac failure, and so on. Our aim is to improve the patient survival rate through adoption of rapid percutaneous catheter-based circulation assistance.



### Catheter-based treatment for mitral regurgitation

This is a catheter-based treatment wherein the part responsible for mitral regurgitation is clipped. The first case treated by this technique in a clinical trial was carried out at NCVC. Thus, we played a pivotal role in introduction of this treatment. It is a minimally invasive treatment that can be used for high risk patients and we have a wealth of experience with this treatment.



### Balloon pulmonary angioplasty (BPA)

It is now possible to open the stenosed lesions in pulmonary arteries using a catheter for patients with chronic thromboembolic pulmonary hypertension who are inoperable. NCVC is a leading hospital of this procedure in the world.



### Leadless devices

Various miniaturized devices that do not require transvenous leads have now become available. These devices can significantly reduce the physical burden on patients as they can reduce the risk complications like infections and eliminate the need for pockets. We select the optimal treatment according to the patient's background.



### Robotic surgery using da Vinci Surgical System

The system is equipped with four arms and a 3D camera. Surgeons operate in the console and remotely controlled system operates on patients. Robotic surgery is indicated for heart valve repair and internal thoracic artery harvest. NCVC provided excellent outcomes with two expert surgeons.



### Endovascular stent grafting

In cases with acute aortic syndromes such as acute aortic dissection and rupture of aortic aneurysm, we carry out, if suitable, minimally invasive stent grafting wherein an artificial blood vessel is installed within the affected blood vessel, apart from performing direct access open heart surgery.



# Cutting edge stroke treatment systems established for reducing stroke disabilities

At NCVC, we are conducting world-leading treatments in cerebrovascular diseases including acute care and drug development.

## Introduction of Departments

### ○Cerebrovascular Medicine and Neurology

Comprehensive acute stroke care is provided in Stroke Care Unit (SCU). NCVC has contributed to establish various acute medical treatments such as intravenous t-PA therapy and diagnostic methods of acute stroke like ultrasonography and other imaging modalities. Our stroke service is available for 24/7 to perform reperfusion therapy including endovascular thrombectomy in close collaboration with Neurosurgery Department. We are actively cooperating with local rehabilitation hospitals, long term care hospitals/facilities and family physicians.

### ○Neurosurgery

A major feature of this division is that it can provide top level treatments in microsurgery, endovascular surgery (catheter-based treatment) and stereotactic radiosurgery (gamma knife). We have a Neurocritical Care Unit (NCU) and can handle emergency neurosurgery and endovascular intervention on a 24-hour basis.

## Rapid and appropriate assessments to reduce disabilities in hyper-acute stroke

We work on improving stroke outcomes through rapid acute management to reduce time to treatment. Specifically, we provide educational activities which enable people to recognize stroke symptoms and paramedics to achieve speedy transportation with feedback on cases. We share patients' information and perform interactive exchange of opinions with convalescent rehabilitation hospitals. We are leading stroke care in Japan as we have introduced intravenous t-PA and endovascular thrombectomy using imaging selection in acute stroke beyond standard therapeutic time window.



## Brain surgery that capitalizes on cutting edge technology and facilities

The department provides surgical treatment for all types of cerebrovascular disorders including intracranial aneurysms, cerebral arteriovenous malformations, moyamoya disease, and carotid artery stenosis. We deal with refractory cases through a hybrid treatment of direct neurosurgery, endovascular intervention and gamma knife. The safety and effectiveness of simultaneous direct neurosurgery and endovascular intervention in hybrid operating rooms (2011 onwards) have improved further with the opening (in 2019) of a biplane hybrid operating room for neurosurgery. Also, a special outpatient unit has been set up for treating cerebral arteriovenous malformation and moyamoya disease. This has now become a major treatment hub for these diseases in the country.



## Research on blood vessel disorders as a possible cause of dementia

Injury to blood vessels can lead to onset of dementia. Therefore, we are carrying out a clinical trial to examine the possibility of widening the therapeutic use of drugs that act on blood vessels. Cilostazol was found to have a role in promoting excretion of amyloid  $\beta$ . Based on this, we are conducting a physician-led clinical trial on patients with mild cognitive impairment jointly with several medical institutions from all over Japan. We have also demonstrated through our research that taxifolin, a component found in wild plants, prevents aggregation of amyloid  $\beta$ , contributes to recovery, and improves spatial cognitive ability.



## Mechanical thrombectomy

In our institute, various stent type thrombectomy devices and reperfusion catheters can be used for successful recanalization of the occluded cerebral vessels. Taking into account the location of occluded vessel and the type of thrombus embolized, a team of the specialists for neuroendovascular therapy administers the treatment to achieve successful recanalization promptly and safely.



## Intracranial stereotactic radiosurgery (Gamma Knife)

Building on Leksell Gamma Knife® precision and adding new technology, Leksell Gamma Knife® Icon™ gives clinicians the option to perform single or fractionated frame-based or frameless treatments, allowing for more individualized delivery—without sacrificing precision and accuracy.



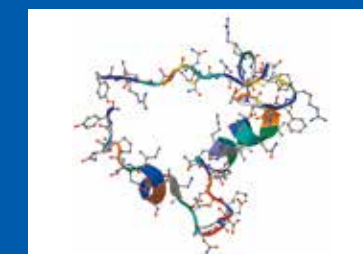
## Acute stroke rehabilitation

It is known that reorganization of the structure, function, and nerve fiber connections (neural plasticity) of the affected tissue occur most strongly immediately after a stroke onset. We provide rehabilitation at an early stage after the stroke onset so that the lost functions can be restored to the maximum extent possible. We are also working on a new rehabilitation program designed specifically for this phase of stroke.



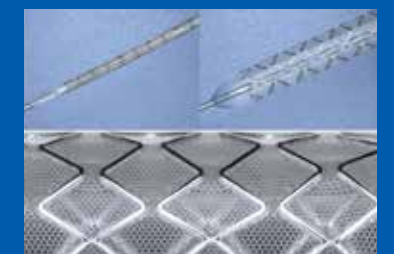
## Research on relationship between tooth decay bacteria and brain hemorrhage (RAMESSES Study)

It is known that certain tooth decay bacteria get into blood vessels and cause bad effects when they enter cerebral blood vessels. Currently, we are conducting some longitudinal studies on the relationship between asymptomatic or symptomatic brain hemorrhage and tooth decay and gingivitis in collaboration with Department of Dentistry of NCVC.



## Adrenomedullin (AMFIS Study)

Research to establish adrenomedullin, a peptide hormone, as a therapeutic drug for cerebral infarction is ongoing. Treatment through blood vessels is widely used but the use of such treatment to protect damaged blood vessels is the first of its kind, and a path breaking effect is expected.



## Development of a covered stent system for intracranial aneurysms

A novel microporous covered stent system (NCVC-CS1) was developed by the collaboration between the Research Institute and Department of Neurosurgery of NCVC for treatment of intracranial aneurysms. An investigator-initiated clinical trial supported by the Japan Medical Association and AMED were carried out to evaluate its efficacy and safety, resulting in an excellent outcome. The system is now in deliberation for early pharmaceutical approval.



# Achieve consistent support for cardiovascular diseases, from prevention and early detection to rehabilitation

We are working on early detection and appropriate treatment of lifestyle-related diseases such as hypertension. Furthermore, we believe it is important to prevent cardiovascular diseases such as stroke and myocardial infarction.

## Introduction of Departments

### ○Diabetes and Lipid Metabolism

Specialized medical examination and treatment are provided for diabetes, dyslipidemia, arteriosclerosis, obesity, hypertension, etc. based on the rapidly advancing treatment strategies and testing devices, and the latest medical findings. The goal is the prevention of cardiovascular disease.

### ○Nephrology and Hypertension

We work on detailed diagnosis and treatment of kidney disease and hypertension. In addition, we provide various extracorporeal circulation therapies, mainly hemodialysis.

### ○Preventive Cardiology

Our main clinical services are health checkups and health guidance based on the regulation of act on assurance of medical care for elderly people and long-life medical care system and, advanced comprehensive cardiovascular health checkups (cerebral and cardiovascular super-dock) and smoking cessation clinic. We also provide improvement guidance of living habits through the NCVC health management system that leverages ICT. Furthermore, in the Suita cohort study, we have published several research papers to provide scientific evidences for the prevention of cardiovascular diseases in Japan.

### ○Stroke and Cardiovascular Rehabilitation

Cardiovascular diseases such as stroke and acute myocardial infarction have common risk factors (smoking, hypertension, diabetes, etc.) and pathophysiology. This department provides specialized rehabilitation for stroke and other cardiovascular diseases while at the same time working on the education of patients and exercise therapy for preventing relapse.

## Prevention of the onset and aggravation of cardiovascular diseases, by the use of the latest therapies for diabetes, dyslipidemia, and obesity

Examination, treatment, and clinical research for preventing the onset and advancement of cardiovascular diseases are undertaken using the latest treatments for diabetes, lipid abnormalities, and obesity. This includes the use of recent rapid advances in therapeutic drugs such as GLP-1 and SGLT2, improved control of glucose level fluctuations through continuous monitoring (CGM), and improvement of lifestyle through team-based care involving consultation with various specialists including psychologists. We have treated a large number of cases that were found by other institutions to be difficult to treat, including those involving cardiovascular complications and extremely obese patients weighing 200 kg or more, and referred them back.

## Specialist diagnosis and treatment for renal diseases and hypertension

Chronic kidney disease is recognized as a major risk factor for end-stage renal disease and cardiovascular diseases. We are actively conducting renal biopsy for diagnosis and specific immunosuppressive treatment for chronic glomerulonephritis. We conduct maintenance dialysis, prevent progression to end-stage renal failure, and prevent cardiovascular disease in patients with chronic kidney disease. We also provide extracorporeal circulation therapies for acute kidney damage and various serious conditions. Recently, we started peritoneal dialysis and started to guide the choice of renal replacement therapy.

## Emphasis on comprehensive cardiac rehabilitation aimed at preventing recurrent cardiovascular disease events

During hospitalization for a cardiovascular disease such as acute myocardial infarction, the impaired cardiac function and the forced rest reduce functional capacity, and inevitably cause strong anxiety about future activities and mobility. In the cardiac rehabilitation program, exercise training improves physical activity and restores self-confidence, and patients can develop appropriate exercise habits and healthy lifestyle to reduce the progression of atherosclerosis and prevent recurrent cardiovascular disease events.



## Genomic medicine

Today, Genomic Medicine - personalized medicine based on individual genetic background - is highly awaited, in accordance with great technological advancements. In April 2017, NCVC launched the Department of Genomic Medicine in order to integrate already existing division-based genetic healthcare and to innovate new genomic approaches for preventing and treating cardiovascular diseases as well as lifestyle diseases. The infrastructure for the genomic medical care, including genetic testing and genetic counseling, has been built mainly targeting inherited arrhythmia, connective tissue disorders (Marfan syndrome) and familial hypercholesterolemia. We also aim to provide optimized medicine for individual patients using next generation sequencers, which includes high-quality clinical genetic diagnosis, effective therapeutic strategies, and prevention of disease aggravation and even disease onset.



## Health Support Center

Cardiovascular diseases can cause sudden onset of serious conditions such as acute myocardial infarction, acute aortic dissection, and stroke, which are sometimes fatal if not treated in time. Therefore, prevention and timely diagnosis before the occurrence of such serious conditions are very important. The newly opened Health Support Center of NCVC carries out a comprehensive cardiovascular examination, and consultation (including on painless delivery, sleep apnea syndrome, etc.). Those who wish to receive treatment at NCVC are assigned to outpatient or inpatient follow-up.



## The Suita Study

The Suita study is a unique follow-up study in Japan for residents in urban areas that began 30 years ago. Numerous achievements have been made regarding fundamental risk factors for cardiovascular disease and are cited in various guidelines. With the aging of the population, we have recently developed tools for predicting myocardial infarction and atrial fibrillation, which are major risk factors for heart failure and aiming to develop new preventive medicine.



## Advanced comprehensive cardiovascular examination

In September 2013, we launched a project to gather basic information about the physical form and roles of body parts to promote the development of highly advanced medical care. A large number of people are availing of this checkup facility. From its details, it may be called an "advanced comprehensive medical examination" for early detection of cardiovascular diseases as the participants are examined through numerous noninvasive tests while they stay in comfortable special rooms.



## Familial hypercholesterolemia (FH)

Genetic analysis has been performed in FH patients for the diagnosis and treatment, search for novel genes that are involved in cholesterol metabolism and prediction of the future cardiac events. To contribute to improvement of the diagnostic rate of FH, we have been involved in making the guideline and establishing the method that measures the thickness of the Achilles tendon by echography.



# Technology that firmly links life from the fetus to adulthood

Pediatrics, Obstetrics and Gynecology

While paying attention to the burden on the patient, we are engaged in R&D of diagnosis and treatment to bring down the number of lives lost to zero, and strive to establish therapies that would ensure high QOL throughout life.

## Introduction of Departments

### ○Pediatric Cardiology

A wide range of patients, including those with congenital heart disease which is our main area of expertise, are diagnosed and treated. These include patients with arrhythmia, myocardial diseases, pulmonary hypertension, Kawasaki disease, coronary arterial disorders, chronic heart failure and complicated congenital heart disease, and those with severe heart failure who require heart transplantation.

### ○Treatment of Adults with Congenital Heart Disease

More than 300 adult patients are treated under hospitalization and managed annually. In particular, we provide preconception consultation and evaluation, and treatments aimed at improving the quality of life of sicker patients such as those who have undergone the Fontan surgical procedure.

### ○Pediatric Cardiovascular Surgery

We provide surgical treatment for any type of pediatric cardiovascular diseases. We are also the specialists for adult with congenital heart disease (ACHD) of any age groups, regardless of corrected or uncorrected.

### ○Obstetrics

We handle about 300 cases of delivery annually. Pregnancy and delivery management of mothers who have heart disease or cerebrovascular disease, or whose fetuses have heart disease, is also provided.

## One of the best pediatric cardiovascular departments in Japan

We have been contributing to develop new surgical strategies for complex congenital heart diseases, including the "Double Switch Operation (DSO)" for congenitally corrected transposition of great arteries and Ross procedure for congenital aortic valve diseases. Both procedure requires high levels of technical expertise and only a few medical facilities in the world can undertake them. Fontan procedure without cardiopulmonary bypass, which only a few institutes can achieve in the world, is possible in our hospital with excellent outcome of post-Fontan patients more than 500 and long term (>20 years) of follow-up. We have also been actively promoting the development of cutting edge diagnosis and treatments such as catheter-based treatment. Patients come to us from all over the country for pediatric heart transplants and artificial heart treatment.



## Safe and reliable pregnancy and delivery management

In recent years, the possibility of women who would have earlier given up on pregnancy becoming pregnant has been increasing. In pregnancies complicated by heart disease, we support both the mother and the child by providing painless delivery through epidural anesthesia for protecting heart function, complete prenatal checkup of the fetal heart, and non-invasive prenatal testing (NIPT). It has been our endeavor to make NCVC a place that connects lives of generations, such as when a baby girl with heart disease born here grows up to adulthood and returns to deliver her own child at the place of her birth.



# Innovative therapeutic strategies for severely advanced heart failure

Organ and Tissue Transplantation Treatment

We are engaged day after day in research and clinical practice to save patients' lives and improve their QOL by bridging basic studies and clinical care.

## Introduction of Departments

### ○Department of Transplant Medicine

Transplantation cardiologists take a leading place in providing interdisciplinary therapeutic strategies for severely advanced heart failure which cannot be treated with conventional medical or surgical therapies. For this, they use mechanical circulatory support devices such as Impella® and left ventricular assist devices (LVAD) for cases of acute and severe heart failure, such as acute cardiogenic shock arising from fulminant myocarditis. Similarly, interdisciplinary treatment including the use of LVAD and heart transplantation is given to chronic advanced heart failure patients with dilated cardiomyopathy and post-myocardial infarction.

### ○Department of Artificial Organs, Research Institute

We have developed a variety of artificial organs that have contributed to advances in the treatment of severe heart failure. These include an extracorporeal ventricular assist device, which is the first one to be clinically available in Japan. Both clinical and basic researches have been performed focusing on clinical management of artificial organs to suppress complications under clinical use as well as to improve quality of life of patients, whereas development and practical application of variety of artificial organs with innovative technologies have been performed.



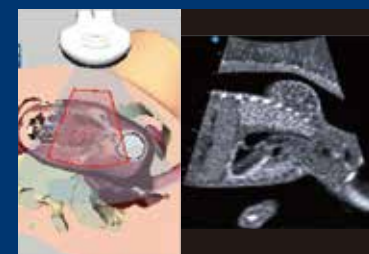
## Treatments that make people feel secure because of our rich experience

As of June 2019, we have implanted more than 400 left ventricular assist devices (LVAD) and done 122 heart transplants, the highest record in Japan, and the 10-year survival post heart transplant is the best globally at 95%. Since 2011, the implantation of continuous flow LVAD (cf-LVAD), a device approved for reimbursement by the National Health Insurance System as a bridge to transplant (BTT), has also been on the increase, with 30-40 such devices being implanted annually. We have achieved 93% 3-year survival post fitting. Treatment of severe heart failure in children is also undertaken actively. Two children aged less than 6 have been given heart transplants after implanting EXCOR, a pediatric extracorporeal VAD, and one less than 10 year old boy fitted with a Jarvik 2000 cf-LVAD underwent heart transplant. In recognition of this performance, Abbott Laboratories has certified us as a Center of Excellence, an honor so far awarded to only 9 institutions world over. We are currently providing training to VAD facilities of Asian countries.



## Development of artificial organs including circulatory assist devices, heart-lung assist devices, etc. in order to contribute on treatment of patients

Since the 1980's, NCVC has been contributing to saving patients' lives and advancing medical science through our research and development, which yielded the NCVC-type pneumatic ventricular assist device, a high performance artificial lung, a heart-lung assist system with the artificial lung, and artificial heart testing devices, etc. that have had definite contribution for medical research. Currently we are dedicating the development of an extracorporeal continuous-flow ventricular assist device and a portable ultra-small and light-weight heart-lung assist system aiming at achieving their practical application within a few years. Furthermore, we are also making efforts to establish evaluation and examination guidelines for pharmaceutical approval of high risk innovative therapeutic devices as well as for investigator-initiated clinical trials.



## Fetal stage diagnosis of heart disease

We use sonography to test the fetal heart for disease. Presently, about 70% of babies who have heart disease that requires immediate hospitalized treatment after birth are diagnosed at the fetal stage. Thus, their treatment can be planned well even before birth.



## Common congenital heart diseases

We are ready for the treatment of the most critical form of congenital heart diseases such as hypoplastic left heart syndrome, right atrial isomerism with total anomalous pulmonary venous connection and others. The common congenital heart disease such as ventricular septal defect and tetralogy of Fallot are also welcome to treat in our institute. We have specialists from neonates to adults with congenital heart disease.



## Congenital heart disease in adults

Currently, many patients with congenital heart diseases overcome the effects of childhood surgery and reach adulthood. NCVC is one of the biggest facilities in Japan where adult patients with congenital heart disease have their pathophysiological conditions evaluated, given catheter-based treatment, re-operated, and given preconception testing if they are women.



## Compact extracorporeal ventricular assist device (VAD) for treatment of acute severe heart failure

We have developed a novel artificial ventricular assist system, BR16010 (a combination of a centrifugal blood pump, cannulas, and circuits) that is antithrombotic and enables continuous up-to 30-day use, which was not possible with conventional devices, for treatment of acute severe heart failure. An investigator-initiated clinical trial was conducted in 2018 with nine patients. In all the cases, the patients were either changed to cf-LVAD or showed sufficient heart function recovery to be weaned from the investigative device and got discharged from the hospital. It is expected that the system will get pharmaceutical approval soon.



## Portable ultra-small, light-weight, next generation extra-corporeal membrane oxygenation (ECMO) system for circulatory and respiratory support

As a result of continuous R&D for more than 30 years, NCVC has succeeded in development of a next generation ECMO system that has excellent antithrombogenicity and long-term durability, and is portable, ultra-small and light-weight. Since March 2020, we have been conducting an investigator-initiated clinical trial of this ECMO system applied to patients with severe heart and/or respiratory failure.



## Cryopreserved homograft transplantation

Cryopreserved homograft transplantation is a medical procedure wherein a donor's cryopreserved heart valve and blood vessel are transplanted (covered by National Health Insurance from 2016). Artificial valves and blood vessels are useful, but homografts are better suited for heart repair surgery for neonatal congenital heart disease, heart valve replacement surgery of young women who wish to conceive, and patients with severe infective endocarditis.



## Nurses are required to sharpen knowledge and skills, as practitioners of nursing and coordinators of team medicine, to provide high-quality care made possible by the capabilities of all nurses

### Nursing

#### ○Department of Nursing

##### [Vision]

- Nurses should properly understand the needs for patients who have different health conditions. They shall treat patients with the latest knowledge and technology to assess nursing issues to perform their duties with personal attention and creativity.
- Understanding the social changes related to medical care, nurses should support patients' decision making by building good relationships. The role of the nurse is to work with various other professionals as coordinators of interdisciplinary teams, and to be in charge of nursing professionals for the part of insurance and health care.
- As nurses who specialize in cardiovascular disease nursing, we constantly try to educate ourselves, motivate others to grow through education and always make efforts to disseminate updated information nation-wide.

#### The philosophy of the Department of Nursing is to embody the mission of nursing professionals

Cardiovascular disease nursing requires various skills in high quality nursing that needs observation for facing the dangers of patients' lives and needs to properly care and assess. Cardiovascular disease nursing can be said to be the origin of observing and handing over life that connects all other fields of nursing. Nurses and midwives of NCVC get together and study to improve their skills in cardiovascular disease nursing and grow professionally through learning and experience. The three philosophies for the Department of Nursing specifically articulate how we need to perform our duties, as professionals and NCVC nurses.

#### The NCVC Career Ladders supports nurses to achieve their goals

The Department of Nursing has NCVC Career Ladders that supports nurses to achieve their individual career goals on their Responsibilities and to help design their career based on their capabilities, life style and social needs. The Generalist Ladders are structured for helping the basic growth as a nurse while pursuing their careers. The Specialist Ladders are designed for enhancing their specialties for cardiovascular disease nursing. The Generalist Ladder in particular has activity goals in each level in order to grow five skills in nurse philosophy, and to continue their efforts to achieve the goals through group training and on-the-job training.



## Duties of pharmacists in the ward strengthened to promote appropriate use of pharmaceutical products

### Pharmacy

#### ○Department of Pharmacy

Appropriate use of pharmaceutical products is promoted by the Department of Pharmacy through dispensing and medication counseling, pharmaceutical cares, management of drugs and drug information, drug formulations, TDM, team medical care, research, etc. We also have training programs for pharmaceutical university students and pharmacists.

#### Satellite pharmacies that support team medical care

Satellite pharmacies have been set up in all the wards of the new hospital and duties of pharmacists in the ward have been strengthened. Pharmacists check medicines that patients bring in and their medication history, and hold classes to educate patients. In addition to this, they accompany doctors on their rounds of the wards, attend conferences, and join interdisciplinary medical teams to further enhance collaboration with other professionals in the hospital.



## State-of-the-art imaging technology for minimally invasive treatments and surgeries

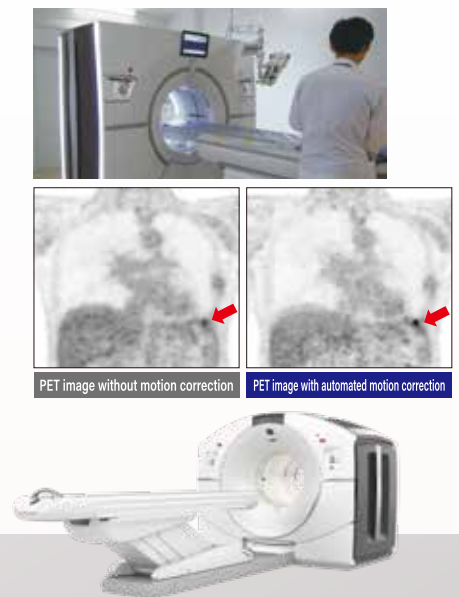
### Diagnostic Imaging and Interventional Radiology

#### ○Department of Radiology

We provide patient-centered diagnostic imaging service using state-of-the-art systems of computer tomography (CT), magnetic resonance imaging (MRI), and nuclear medicine. Nuclear medicine, scintigraphy and positron emission tomography (PET), is a modality for functional imaging using radioactive tracers. We also carry out interventional radiology, minimally invasive treatments using catheters and angiography system.

#### Cutting-edge imaging systems and strategies supporting high-quality treatments

In the current NCVC, 3 multi-slice CT scanners, including a novel CT scanner equipped with the world's first 3D camera, 4 three-Tesla (3T) MRI scanners, and 5 machines for nuclear medicine, including an innovative digital PET/CT system, have been newly introduced. Furthermore, 9 most advanced angiography systems, one of which was transferred from the old center, are arranged for diagnostic angiography and image-guided therapy.



## Providing the high quality clinical data for patients

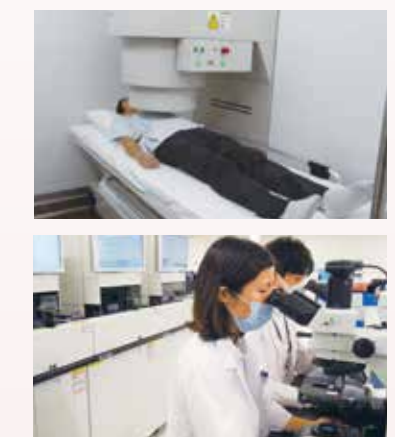
### Clinical Laboratory Medicine and Genetics

#### ○Clinical Laboratory Medicine and Genetics

We can perform electrocardiography, one of the essential tool for diagnosing cardiovascular diseases; ultrasonography of the heart, carotid arteries, peripheral blood flow, abdomen, fetus, etc.; exercise stress tests; specimen tests on blood, urine, microbes, etc.; genetic testing; and blood transfusion management. We make sure that all of the clinical and genetic testing are in high accuracy, and always be for the patients under the international ISO15189 certification.

#### Novel magnetocardiography for diagnosis of arrhythmia, etc.

Magnetocardiography (MCG) can non-invasively measure the small magnetic field generated by heart, using superconducting quantum interference device, which is now only available at NCVC and University of Tsukuba in Japan. MCG can identify the origin of arrhythmia and useful to diagnose not only for cardiovascular diseases and also those in fetus which are usually impossible by the standard surface ECG.



## Providing support to healthcare workers through the operation and management of advanced medical devices

### Clinical Engineering

#### ○Clinical Engineering

We operate and manage advanced medical devices. In particular, the number of heart-lung machines, artificial hearts, pacemakers and circulation assist devices managed by us is one of the highest in Japan. We also provide training to all healthcare workers to achieve safe use of advanced medical devices in the hospital. In the field of research, we collaborate with the Department of Artificial Organs to improve the devices and their management in order to provide stable assisted circulation.

#### Support of clinical engineers for patients with artificial hearts

The Department of Clinical Engineering operates and manages advanced medical devices. With regard to work related to ventricular assist devices (VAD) in particular, clinical engineers with specialist certification take care of operation of the devices, training of the patient and family members, and hospital visits after discharge so that patients with VAD can be free from anxiety during the waiting period from the hospitalization up to transplantation.





# Next generation healthcare realized through open innovation



## Alliances with companies and universities promoted by the Department of Industrial-Academic Collaboration

Collaboration with private corporations and universities is essential for the realization and diffusion of innovative medical technologies. By further development of technology seeds based on clinical needs directly linked to the advanced medicine, the Department of Industrial-Academic Collaboration aims to create the next generation of medical devices, pharmaceuticals, and healthcare businesses.



## Accumulating specimens and clinical information in Biobank

The NCVC Biobank, established in June 2012, has developed with the collaboration of more than 17,000 patients as of 2019. The Biobank provides specimens and clinical information from patients with cerebrovascular and cardiovascular diseases to approved NCVC researchers and those from academia and medical affiliates in joint or collaborating research with NCVC. The Biobank is a project for medical research and development of the new diagnostic testing, treatment and prevention using stored human samples such as blood, serum, and residual tissues dissected during surgery or autopsy combined with medical information.



## Committed to improve the quality of healthcare through programs of the Division of Education and Human Resource Development and the OIC Training Center

The Division of Education and Human Resources Development newly set up in 2017, working in tandem with the OIC training center, provides equipment and infrastructure for training programs in which the trainees learn basic medical technology, surgical operation and management of the latest medical devices. Apart from providing medical education, we also aim to propose concepts of new medical devices and promote their development to improve medical care, anticipating the needs of future. We conduct various training programs and seminars on clinical research, manage specific clinical research projects of physicians and training in designated nursing procedures, and conduct mock training at the Center. In particular, the OIC training center, which is the only facility in Japan that specializes in cerebral and cardiovascular medicine, is equipped with a large number of advanced simulators.



## Committed to create a world-class biomedical innovation cluster by activating innovation

Open innovation which utilizes resources from anywhere in the world has now become essential for realizing next generation healthcare. In Japan, however, the mobility of research talent is very low, and the flow of the necessary knowledge is also underdeveloped. At NCVC therefore, the Research and Development Initiative Center was restructured in April 2019 to create the Open Innovation Center (OIC) with a structure that would facilitate convergence of the required knowledge and utilization of resources. **Science Café** has been opened in OIC to increase opportunities for communication between researchers and medical doctors with the hope of incubating new ideas. Interaction among researchers will be accelerated by providing seminars and other events. Joint researches with many private companies will be conducted under one roof in the newly established **Open Innovation Laboratory**.



## Examples of joint with private corporations

### 1. KENTO Condominium Project

Our joint project with Kintetsu Real Estate Co., Ltd. is progressing at the constructed apartment house in Northern Osaka Health and Biomedical Innovation Town (KENTO). The residents only take a highly advanced health examination of NCVC for circulatory diseases (once per unit) using the NCVC Health Management system (e.g. receiving advice from NCVC by transferring data such as blood pressure or body weight to pre-installed medical equipment in each unit via internet). In contrast to periodic health examination like cohort study, we aim to develop new preventive methods of cerebral and cardiovascular diseases by collecting and analyzing daily-based longitudinal dataset.

### 2. KENTO Heart Safe City Project

This is a joint research project with Philips Japan. Automated external defibrillators (AEDs) have been positioned systematically in the KENTO and persons who can provide emergency treatment before the arrival of emergency medical service are being trained as first responders. With this project, we pursue to achieve the world's highest survival rate after cardiac arrest.

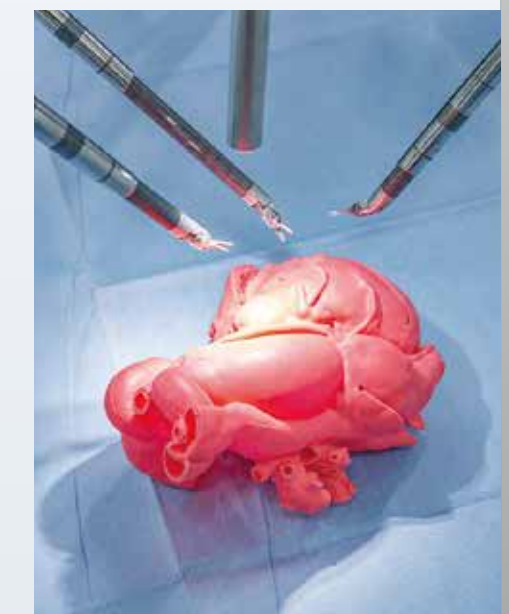
## Omics Research Center deciphers unexplored molecular basis of cardiovascular diseases by means of multi-omics approaches

Omics Research Center (ORC) was founded in April 2015 aimed at interrogating unexplored molecular mechanisms underlying several cardiovascular diseases and identifying novel biological, genetic, and clinical markers to achieve early diagnosis and prevention of patients at risk. ORC implements multi-omics approaches including comprehensive genetic, genomic, proteomic, transcriptomic, and even physiomic analyses, and takes advantage of international collaborations.



## Analyzing nationwide dataset in the Center for Cerebral and Cardiovascular Disease Information

The center is collecting data related to cerebral and cardiovascular diseases throughout Japan to accurately identify the cause of morbidity and other outcomes. For this purpose, the center administers the Japanese Registry Of All Cardiac and Vascular Diseases (JROAD) Survey jointly with the Japanese Circulation Society and performs the Japan Stroke databank and Disease Registry. The center's goal is to accurately explore disease-related information, to formulate the detailed dataset by enhancing the in-hospital registration system, to provide the research environment for analyzing the nationwide dataset and give those results back to people and to investigate common risk factors and solution of both stroke and cardiovascular diseases by aggregating the nationwide dataset.









# Responsibilities of this National Center for Advanced and Specialized Medical Care and Research (NC) where cerebral and cardiovascular specialists of medical care and research are trained

The NC focuses its efforts in education of young healthcare providers and researchers, as a center that leads Japan's cerebral and cardiovascular care.

## Various opportunities offered for nurturing human resources

NCVC's physician training program has two streams. One is a Resident Training Program for doctors who have completed junior residency, to acquire wide-ranging knowledge and technical expertise. The other is a Specialist Training Program for doctors to hone their skills in specialized fields chosen by them. Residents and Specialist doctors trained by us, whose number now exceeds 2000, are actively showing their merit in Japan and abroad.

As for nurses' training, we have a system for training not only generalists but specialist or educator nurses. Training in designated procedures, a first of its kind program started by the NC, and NCVC's Cerebral and Cardiovascular Expert Nurse (CVEN) accreditation program are contributing to improvement in the quality of nursing.

Our Research Fellows Program is for nurturing young research talent. The Research Institute of the NCVC undertakes peptide exploration and device development, apart from research on pathophysiology. Therefore, we accept also researchers from fields other than medical research. Quite a few young researchers are producing many promising research results through collaboration with the Hospital, which is a unique feature of the NCVC.



## Training of young doctors to prepare them to shoulder the task of developing cerebral and cardiovascular medical care in Japan

The resident training period for doctors after completing junior residency is three years and the trainee doctors acquire all-round experience in the department they choose.

The specialist training period for doctors who have completed the senior residency is two years in principle and they receive specialized training in the field of their specialization. A shorter training than previously is also available from FY2018 in response to changes in training system of young doctors. NCVC actively undertakes clinical research that might lead to the development of new treatment methods apart from providing cutting-edge treatment. A large number of research papers with a resident or specialist trainee doctor as the senior author have been published. Also, it is possible for the doctors to obtain a postgraduate degree through our joint postgraduate school program.



## Advanced nursing practitioners are produced through designated procedure training courses

From FY2019, we are the first National Center to start an 8 category 21 part designated procedure training course. This training course, named the "Severe case intensive management course," capitalizes on the advantages of this advanced treatment hospital that provides highly advanced cerebral and cardiovascular medical care. We have created an educational program and system where specialist doctors with rich experience and other specialists work together to train the nurses so that they can perform their roles satisfactorily in the interdisciplinary medical teams that treat severely ill patients who require intensive care. In particular, nurses acquire heightened clinical insight and an ability to assess the patient's condition through the highly practical education received at the training center within the NCVC. The goal is to enable the nurses to contribute to safe and high quality medical care based on transparency and a high level of ethics.



## Youthful talent channeled into controlling cerebral and cardiovascular diseases

As a research fellow, one can entirely concentrate on research activities at the Research Institute. Research is not restricted to conventional basic and clinical medicine but includes numerous fields such as genomic medical science, peptide and protein science, physiological function analysis, molecular imaging, regenerative medicine, drug discovery, and development of artificial organs and diagnostic methods. This has yielded highly innovative outcomes and patented products and technology. An Open Innovation Center (OIC) has been established as a unit that links the Research Institute with the Hospital. The OIC will function as a hub of advanced clinical research and translational research and moreover promote collaboration with industry.



## Resident Awards and Teaching Awards

At the NCVC we give Resident Awards for residents and specialist trainees. This is for realizing, in clinical training, the target levels of knowledge, technique, experience, and basic attitude as physicians. We also have Teaching Awards for staff engaged in supervision and education.



## NCVC's Cerebral and Cardiovascular Expert Nurse (CVEN) accreditation system

CVEN are NCVC's expert nurses. For improving the quality of nursing of cerebral and cardiovascular patients, NCVC nurtures nursing practitioners of a high standard who have completed education and training in various fields and have expert knowledge and technical expertise. There are five courses including cardiovascular medicine and cerebrovascular medicine. CVEN have become models of nursing practice.



## Joint graduate school program

This is a system aimed at contributing to the development of science and technology in which research organizations and graduate courses of universities jointly guide students to improve their competence and promote research exchanges between the collaborating institutions. NCVC has entered into agreements with universities under this system and post-graduate students are being supervised in their research.



## Diversity

The Office for Promotion of Diversity and Inclusion has been established to create a workplace that enables diverse individuals to work to their full potential. This office has created a system to support employees in their efforts to continue working while dealing with life's events. With this, we hope to create an environment where the employees can concentrate on their duties.



## Housing

"DIACREST Kokuju Kento" which has living spaces for single employees and those with families has been constructed next to NCVC. This makes it very convenient for employees to commute to their workplace. With its proximity to JR Kishibe station, it also provides excellent access to Osaka city. NCVC has six housing complexes, including DIACREST, for its staff. We have living quarters reserved for nurses so that young nurses coming from far away home towns can work without worry.



## Childcare facilities

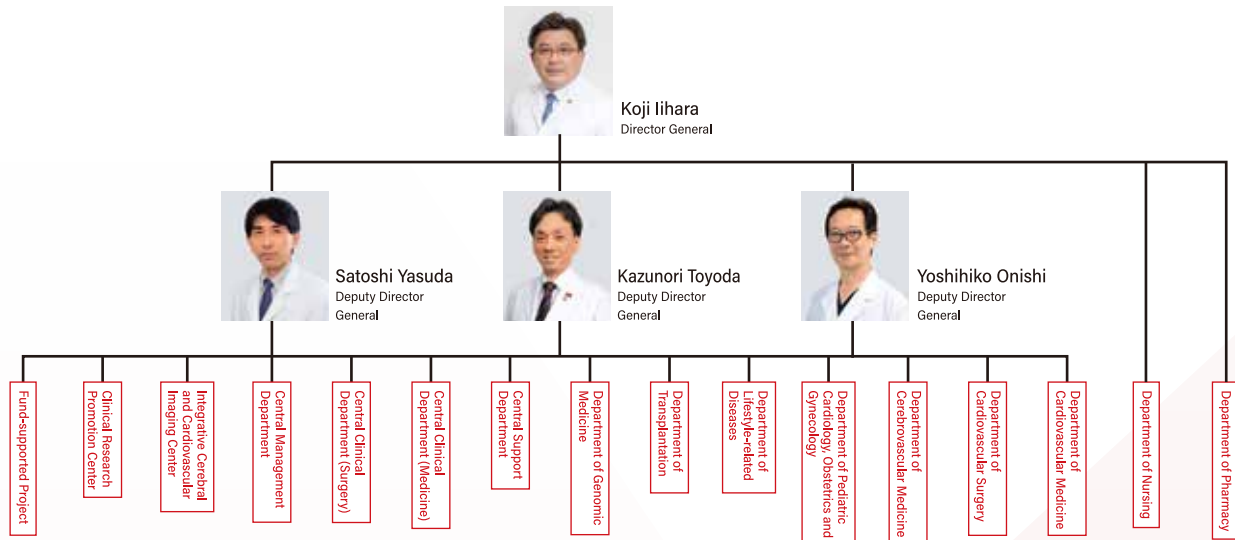
"Ohisama Childcare Center" for exclusive use by our staff is located next to the staff housing. Children ranging from 57 day-old infants up to preschoolers can be admitted there. Extended care for up to 10 pm (Mondays) and night time care (Tuesdays) are also provided for the convenience of staff members such as nurses who have shift duties. A short-term care service is also available for those who do not have monthly contracts (prior registration required).



# Specialists at the cutting-edge collaborate with the aim of creating next generation medical treatment and health care

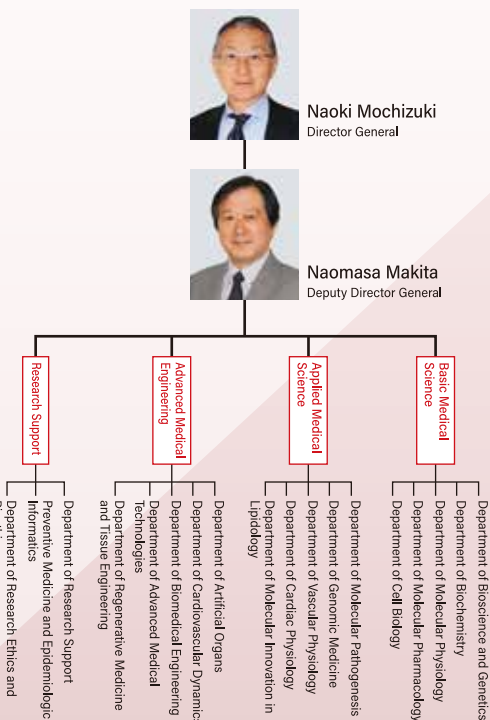
## Hospital

The NCVC is one of the innovative medical institutions in the world, providing advanced treatment of cardiovascular and cerebrovascular disorders. It is the only national center for advanced and specialized medical care and research in Japan that focuses on cerebral and cardiovascular diseases.



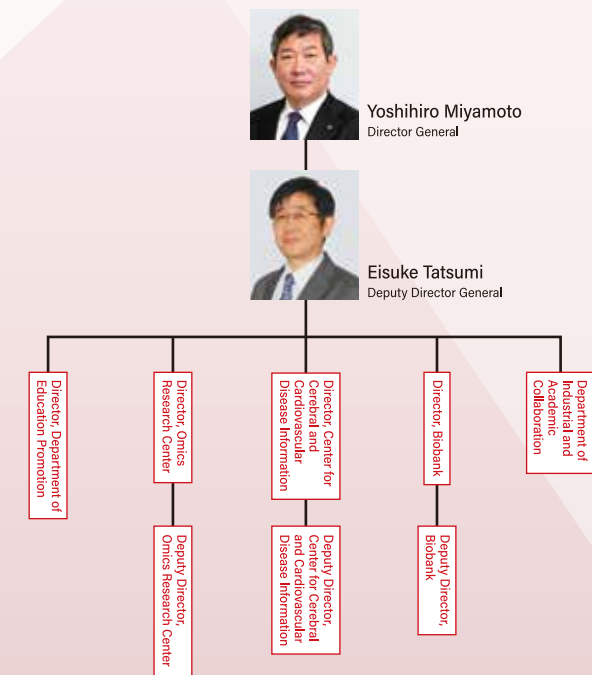
## Research Institute

The most distinctive feature of the NCVC Research Institute is its ability to address the real issues facing clinicians and disseminate research findings back to clinicians. We are actively pursuing R&D and the clinical application of its results jointly with the hospital.



## OIC

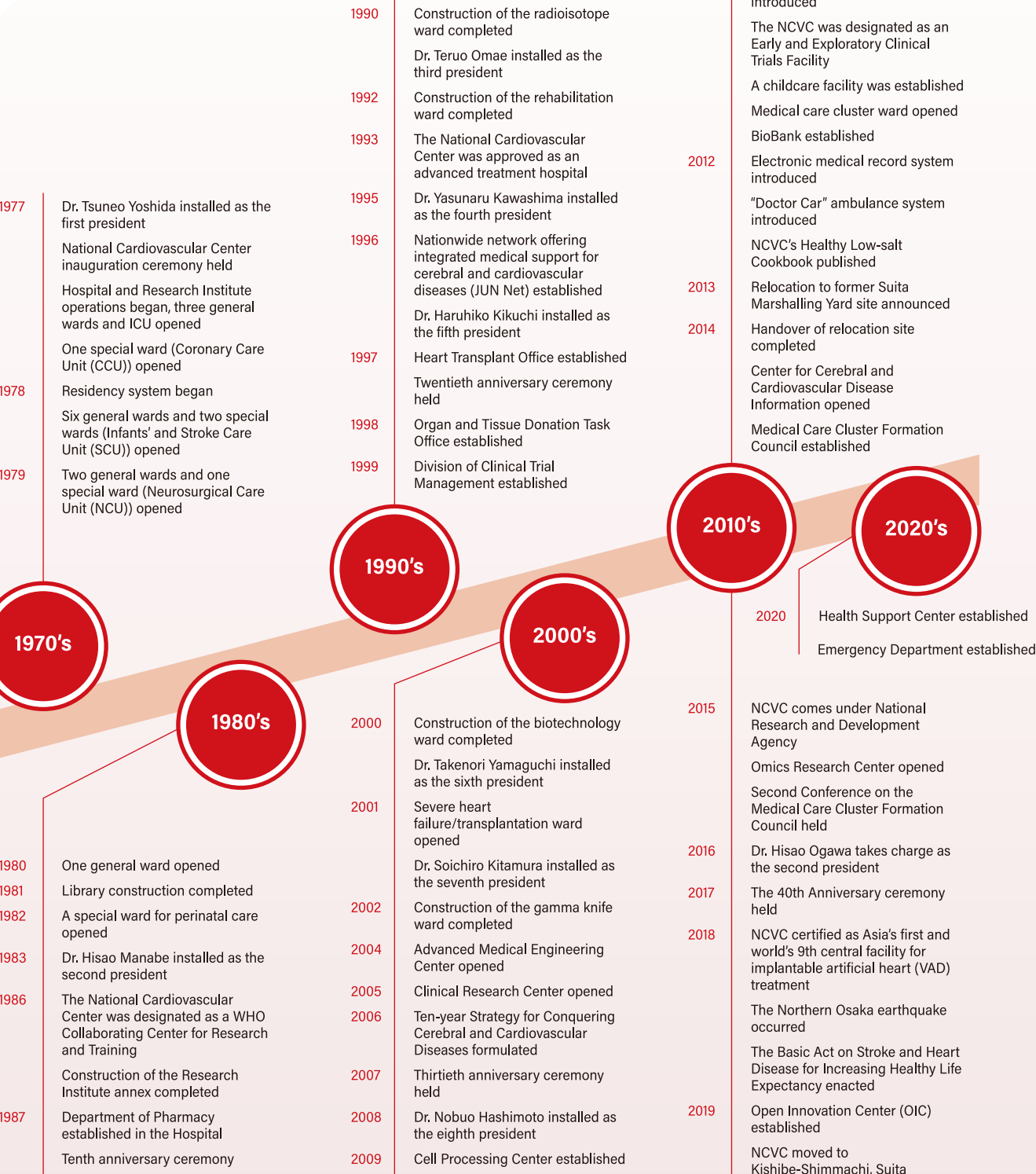
The intellectual assets, resources, and data that we have accumulated until now will all be used for enhancing open innovation through collaboration with industry and academia. We have adopted unique measures such as setting up the "Open Innovation Lab" as a joint research hub, and the "Science Café" as a space for interaction and information exchange among the staff.



## Organization

# Solid steps taken by NCVC to control cerebral and cardiovascular diseases

NCVC has been engaged in treatment and prevention of and research on cerebral and cardiovascular disease since its inception in 1977, with the hope of enhancing people's health and happiness. We have been ceaselessly moving forward for controlling cerebral and cardiovascular diseases, with an open attitude about adopting new technologies.



## History