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SHIMADZU
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MOMENTUM

Vol.02 2014

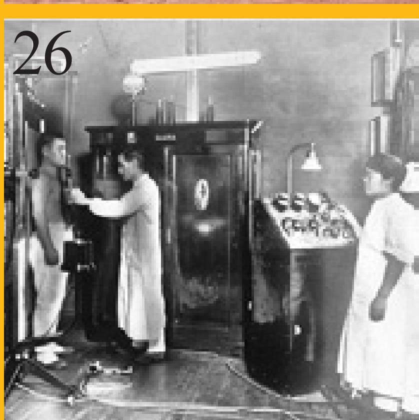
Nano Bio-machines for building the future of Medical diagnostics

Feature 2 : Healthcare in Africa
Global collaboration to install 47 medical X-ray imaging systems in Ghana

Message from Satoru Suzuki, Senior Managing Executive Officer
Striving to discover diseases ever earlier

History of Shimadzu
As The Pioneer of Medical X-ray Apparatus

Contents



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MOMENTUM

Message from Satoru Suzuki, Senior Managing Executive Officer

Striving to discover diseases ever earlier

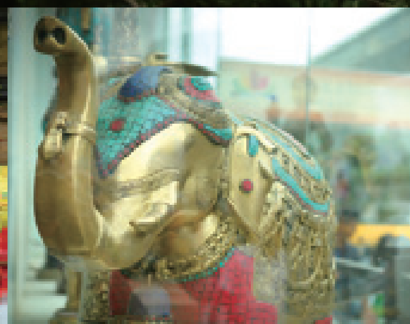
Ever since Shimadzu was founded, we have operated based on our corporate philosophy of “contributing to society through science and technology”. With each generation, we have continued the belief that scientific technology, which is the core of our business, should contribute to the good of society. As a result, our scientific technology is used widely in medical fields, where it has a direct effect on the well-being of society.

Shimadzu’s medical business began with diagnostic imaging systems that use X-rays to look inside the body. In 1909, Shimadzu developed Japan’s first medical X-ray apparatus. Diagnostic imaging helped to reduce the discomfort felt by patients, capturing images of previously invisible areas that caused diseases, and providing treatment sooner. As technology progressed, various diagnostic imaging technologies other than X-rays were created for viewing the inside of the body, such as ultrasound and nuclear magnetic resonance technology. Diseases always have symptoms and causes, and diagnostic imaging technologies such as these have made it relatively easy to link these symptoms with their causes.

Previously, confirming such conditions required an autopsy to determine what was actually occurring inside the body. The only method available was to examine the tissue after the disease had progressed significantly. Since the beginning of modern medicine, mankind has sought for a means of detecting diseases early. Now current advances in diagnostic technology have come a long way toward achieving that ability. However, the desire for even earlier diagnosis capability remains the same. Therefore, we are committed to achieving that capability so that we can contribute to the happiness of people throughout the world.

Senior Managing Executive Officer
Satoru Suzuki

Our diagnostic imaging technology has helped identify causes while symptoms are still relatively minor, thereby contributing to the diagnosis and treatment of diseases. However, there is still much that is unknown about the processes involved in the body as diseases progress. To help visualize those processes and further anticipate diseases, we have taken on the challenge of developing molecular imaging technology. Molecular imaging involves using a mass spectrometer or positron emission tomography (PET) system to visualize the metabolic activities in the body that create or eliminate molecules. It clarifies the causal relationship between specific metabolites and diseases, and enables the prevention and ultra-early diagnosis of diseases based on analyzing components in biological samples, such as blood or urine. In the future, these techniques are expected to enable the early detection of cancers, lifestyle-related diseases, Alzheimer’s, and other conditions.

Nano bio-machines for building the future of medical diagnostics

Yamuna Krishnan describes her research on DNA based nano-devices at the National Center for Biological Sciences in the Tata Institute of Fundamental Research, Bangalore, India.

Republic

# of India

The Shimadzu Corporation prides itself on developing high-quality, highly specialized equipment so that researchers can keep ahead of the game in novel areas of research. One such rapidly evolving field of research is so-called ‘synthetic biology’, and associated structural DNA nano-technology. Much attention has been given recently to the idea of harnessing the potential of natural, biological structures to build new biocompatible, nano-scale devices which can venture where no machine has gone before – namely inside the cells of living organisms.

Yamuna Krishnan, highly regarded Associate Professor at the National Center for Biological Sciences (NCBS) in the Tata Institute of Fundamental Research, Bangalore, India, has dedicated her career to this exciting new area of research. Krishnan’s work, which currently focuses on the creation of tiny, futuristic ‘nano-machines’ based on the structures found in DNA molecules, could have a huge impact on the future of medical diagnostics.

National Center for Biological Sciences

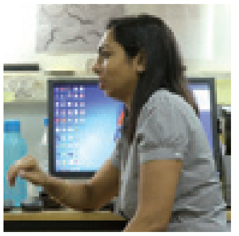
NCBS

Scientists have conducted considerable research into various diseases and how they affect the body on the macro and cellular-scale. However, it is becoming increasingly clear that understanding what happens on a sub-cellular level – for example, how diseases affect protein behavior and the functionality of organelles within individual cells – could provide deeper insights into disease behavior. The ability to monitor and analyze the molecular environment inside different compartments of diseased cells within living creatures would open up a whole new level of comprehension in medical science.

“We are working towards a number of different nano-scale sensors for in vivo bio-imaging, particularly fluorescent sensors,” explains Krishnan. “This new technology will help in furthering understanding of basic biology and what is happening inside both healthy and diseased cells. The sensors could also help distinguish and analyze different disease phenotypes, helping to identify where and how cell function is altered by diseases.”

Using DNA as a natural molecular scaffold, Krishnan and her team of researchers have created nano-scale devices capable of monitoring conditions such as pH levels inside organelles – sub-units or compartments within cells which have specific functions, and are usually bounded by a membrane.

“The tiny machines work by altering their shape when they encounter certain conditions in an organelle,” explains Krishnan. “The conformational change in turn triggers a photonic output as a signal in the form of fluorescence, which can then be analyzed.”



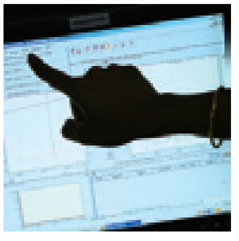
One example of a DNA-based nano-machine developed by Krishnan and her team is the so-called ‘I-switch’. The I-switch is made up of three DNA strands engineered with parts that are sensitive to a certain pH level. The device can be tuned to respond to different acidities as required. At neutral pH the I-switch is linear in shape, but at acidic pH levels, the I-switch changes to a closed triangular shape. Fluorescent dyes attached to the device glow green when linear and red when triangular, indicating the pH levels inside the organelle.

Dr. Yamuna Krishnan

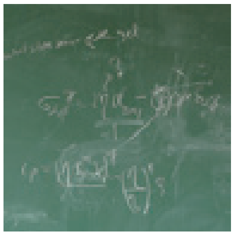
Senior Assistant Professor, National Centre for Biological Sciences

“Changes in pH within organelles can dramatically alter their ability to function correctly,” explains Krishnan. “Defective acidification within organelles can dramatically affect protein behaviour. Rather like a fever alerting you to when someone is unwell, a certain pH value can indicate that something is wrong within the organelle you are interested in. Several diseases are correlated with an altered pH in a specific organelle, so being able to measure pH within cell organelles is very useful.”

In 2013, the team published a ground-breaking piece of research in the journal Nature Nanotechnology, called ‘SimPHony’, based on two pH sensors working in unison within a single living cell. Using two nanomachines, the team were able to gain accurate pH readings in two different parts of the same cell at the same time. This is the first time two nanomachines have worked in concert within one cell, and it represents a major step forward in this kind of technology.



“The ability to read pH values in two parts of the same cell simultaneously, as SimPHony can, helps us to distinguish malfunctioning organelles from those that are functioning normally,” explains Krishnan. “Using one organelle as a ‘control’, we can explore what is happening elsewhere in the same cell and ultimately understand more about how diseases work on a sub-cellular level.”



This new technology could also allow scientists to probe multiple aspects of cellular behavior and disease pathology in different parts of the body at the same time, as well as potentially opening doors to new assays for drug discovery in future. Behind all of the advances in Krishnan’s lab is the access she has to high-tech equipment, as she explains:

"We have Shimadzu Corporation's high-performance liquid chromatography (HPLC) equipment in the lab. It is the backbone of the work we do. Everything starts from the HPLC. It is the back of the kitchen - where we 'lay everything out' before we begin - and without it we could not have achieved the breakthroughs we have had in recent years. A superior HPLC is the reason we can fabricate - with high purity - all our DNA based nano-devices."

Analytical equipment created by the Shimadzu Corporation is at the heart of many of the labs involved in ground-breaking research worldwide, like the work by Yamuna Krishnan and her team in India. The company is committed to supporting researchers across the globe in the future, by continually developing and expanding their range of equipment.

high-performance liquid chromatography HPLC

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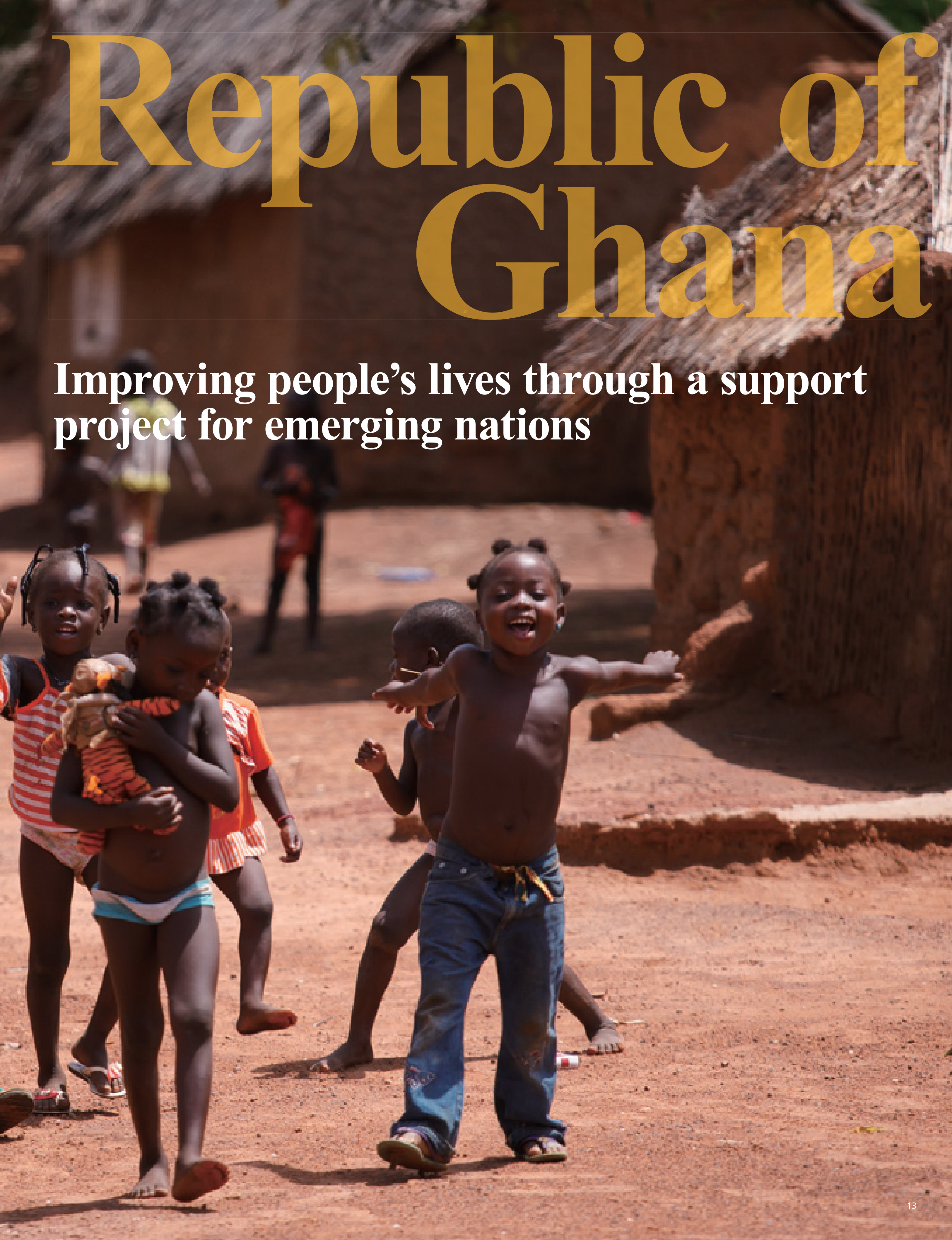
Further information
Yamuna Krishnan: http://www.ncbs.res.in/yamuna/groups_yamuna.htm

National Center for Biological Sciences (NCBS): http://www.ncbs.res.in/

Global collaboration to install 47 medical X-ray imaging systems in Ghana

Republic of Ghana

Improving people's lives through a support project for emerging nations



As global economic growth shifts from developed countries to emerging countries, improvements in social infrastructure such as medical care services has become an urgent issue in order to ensure the sound development of these countries.

Shimadzu is supporting improvement of living conditions in emerging countries by supplying high-quality, functional medical systems

Ghana, located in West Africa, is a Republic with a population of 25 million people. In 1957, it became the first country in Sub-Saharan Africa to gain independence. Although Ghana is one of the world's leading producers of cocoa beans, and its name has become known throughout the world as a chocolate brand, the country has never been rich in underground mineral resources. It has been striving to rebuild its economy in recent years, which deteriorated in response to rising oil prices. In 2011, the country achieved 13.6 percent economic growth due to the expansion of its commercial oil production, which began in 2010, and is now a country that symbolizes "growing Africa." At the same time, due to the prolonged period of economic stagnation, the country's medical facilities have not been upgraded and have become dilapidated.

In Ghana, most health care is provided by the government and largely administered by the Ministry of Health. Healthcare facilities in Ghana fall into the following five types: "health posts" which provide primary care for rural areas, "health centers and clinics", "district hospitals", "regional hospitals", and "tertiary hospitals". There are 200 hospitals in Ghana. Urban areas are well-organized, and have the most hospitals, clinics, and pharmacies in the country. On the other hand, rural areas rarely have advanced medical services. Patients in these areas either rely on traditional African medicine, or travel great distances for health care. In such areas, there certainly is opportunity for Shimadzu to expand the company's medical business in Ghana.

In 2010, when Ghana's Ministry of Health embarked on a project to install medical equipment in 24 hospitals in 10 states with aid from the United States, Shimadzu was the first company they turned to for X-ray systems. This was because Shimadzu's radiography system already had a strong reputation, because Ghana's largest public hospital, Korle Bu Teaching Hospital (with approximately 2,000 beds), had radiography equipment installed in 1992 through Japan's Official Development Assistance (ODA) project. The Shimadzu equipment has been operating reliably ever since.

Although a considerable number of European medical systems have been installed in Ghana's hospitals with aid provided by European countries, many of the systems have malfunctioned and remain unusable due to a lack of after-sales support. That may have led Ghana's Ministry of Health to consider receiving support from North America. Meanwhile, the reliability of Shimadzu's systems and after–sales service has won the confidence of the Ministry. Since this project was funded by the United States, there was some concern that American products would receive priority. However, the Ministry showed a strong desire for Shimadzu equipment.

As the result, Shimadzu received an order for 31 radiography systems, 3 fluoroscopy systems, and 13 surgical C-arm imaging systems. These systems were installed in 2 teaching general hospitals, 16 regional hospitals, and 6 community hospitals in 10 states under administration by the Ministry. The systems have started making a significant contribution to improving medical standards in the country.

Establishment of long-term after-sales support is the key to success

Ato Dear Dsane, Director of AGVAD Medical Systems in Accra, who promoted the project as a partner of Shimadzu in Ghana, says: “Improvements to field services are the key to success. Our success comes from the reliability of Shimadzu’s field services, not just from products’ quality or cost performance. These services must be professional and easily accessible.” In the past, there were cases where installed systems were not fully utilized by users because of lack of adequate field services and incorrect operation. Shimadzu places great importance on the enhancement of field service capabilities. In this context, Shimadzu provides on-the-job training at the time of installation as well as service training to local engineers in order to ensure adequate training and support in Ghana.

This project gave Shimadzu an opportunity to learn that some emerging countries are not capable of efficiently utilizing revenues generated from natural resources for the growth of their domestic economies. As a result, it is support from other countries that is likely to contribute to the improvement of people’s standard of living. Currently there are a number of projects going on in Latin America, Asia, Middle-East and African regions, and Shimadzu will take necessary steps to make inroads into these regions. What is important for such projects is to establish long-term field service support in a way suited to the unique circumstances in each country. Through full product support, Shimadzu hopes to further contribute to the improvement of medical services in many other emerging countries across the globe.

Shimadzu’s radiography system installed in 1992 through an ODA project.

Korle-bu Teaching Hospital in which Shimadzu's systems are to be installed.

Spotlight

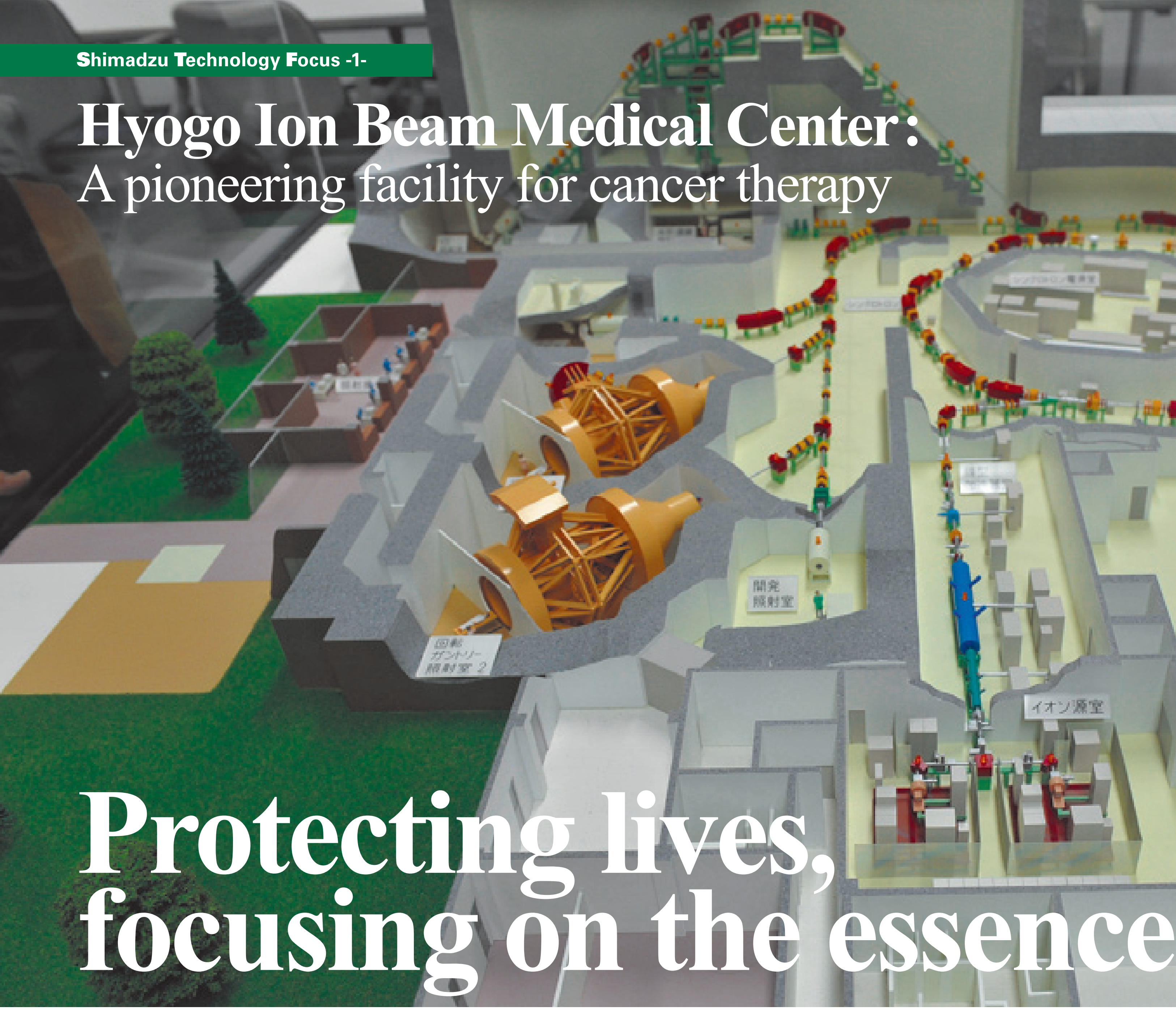
Ato Dear Dsane is the Director of AGVAD Medical Systems, Shimadzu's distributor in Ghana. Mr Dsane says that accident and emergency response and care is one of the areas that require future improvements in Ghana, adding that the X-ray systems are necessary for non-surgical purposes in district hospitals, and c-arm systems are important for the treatment of accidents in the major teaching hospitals.

"We are extremely satisfied with the support from Shimadzu for training staff," says Mr Dsane. "The medical equipment produced by Shimadzu is robust and reliable. In particular our feedback to Shimadzu has been used to develop even better equipment. We are truly happy to working as part of the Shimadzu family."

Ato Dear Dsane

Director of Operations,
AGVAD Medical Systems, Accra, Ghana

Hyogo Ion Beam Medical Center: A pioneering facility for cancer therapy



Protecting lives, focusing on the essence

Treating cancer without the worry of adverse side effects

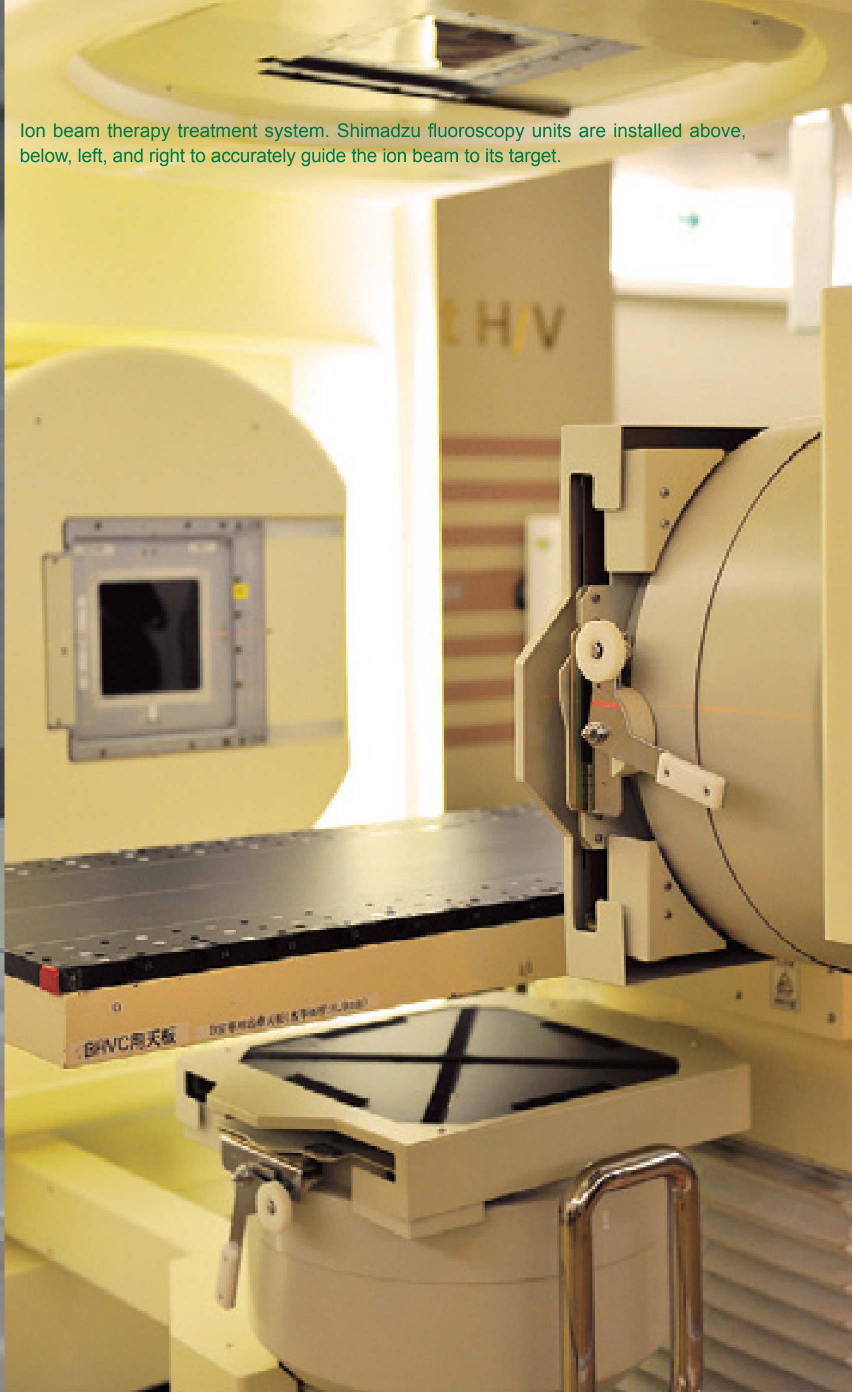
Ion beam treatment is attracting attention as a cancer treatment that does not require making incisions and has minimal adverse side effects. As a pioneering facility for such treatments, the Hyogo Ion Beam Medical Center in Japan is gaining the trust of many patients.

Radiation that attacks only the cancer

As the name suggests, the Hyogo Ion Beam Medical Center is a medical facility that specializes in using ion beams, which are a type of radiation, to treat cancers. Radiotherapy is one of the main tools for treating cancer, along with surgery and chemotherapy. Of the current radiotherapies, ion beam therapy has been attracting particular interest, with many new instruments being developed in recent years. The biggest advantage of using ion beam therapy is the extremely low level of adverse side effects. Based on the characteristics of the ion beam, energy is emitted until the beam reaches a given depth into the body. By carefully controlling the energy of the beam, it can be used to attack only the cancerous cells without damaging the normal cells on the body surface or around the cancer.

"Radiation therapy stops the growth of cancer cells by disabling the cells," explains Dr. Nobukazu Fuwa, the director of the center. "However, any damage to normal cells during the treatment process could eventually increase the risk of cancer. Therefore, systems are being developed to avoid that as much as possible. Of the systems being developed, ion beam therapy is particularly able to limit exposure to only the smallest possible area, which can significantly reduce such risks."

# of life



Ion beam therapy treatment system. Shimadzu fluoroscopy units are installed above, below, left, and right to accurately guide the ion beam to its target.

Two types of ion beams

Currently, there are two types of ion beam therapies. Proton beam therapy uses the proton from the nucleus of a hydrogen atom as its energy source, whereas heavy-ion therapy uses the nucleus of a carbon atom. Since the atomic weight of hydrogen is 1 and the atomic weight of carbon is 12, this difference determines the amount of energy emitted. The Hyogo Ion Beam Medical Center was established in 2001 as the world's first facility able to use both protons and heavy ions for treating cancer. In fact, there are only 11 facilities in Japan that perform ion beam therapy and only four that are able to perform heavy-ion beam therapy. This is the only facility able to perform both.

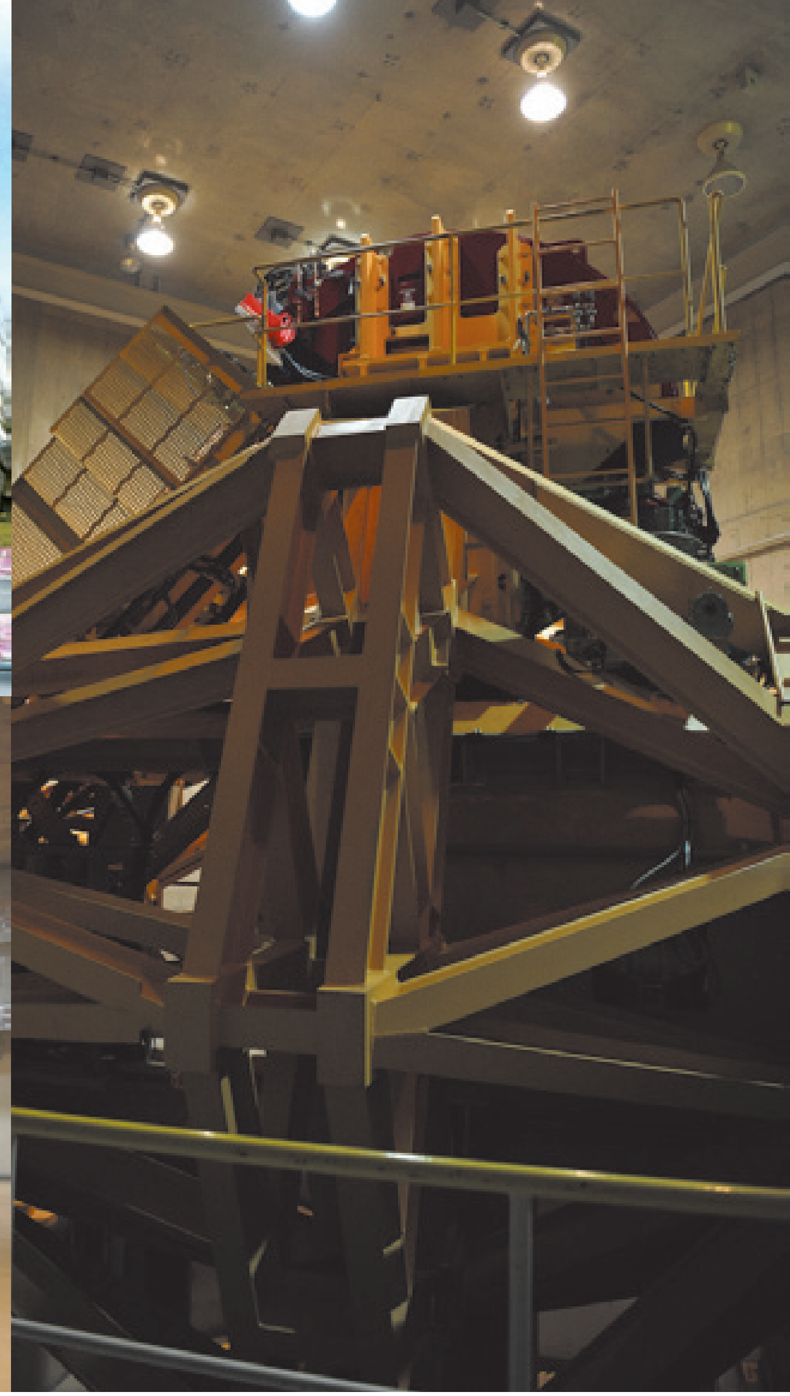
"The most significant feature of this hospital is the ability to choose the type of beam best suited for the situation," says Fuwa. "The heavy-ion beam is definitely powerful, but is a double-edged sword. For example, proton beams are better suited particularly for small children. This means the optimal type of ion beam can be selected for treatment based on the location or type of cancer, the condition of the patient, or other factors."

At this center, ion beam therapy involves first performing a CT scan to determine the shape of the cancer and then using an exposure field shaping jig to form the exposure area into the same shape as the cancer. This means that the ion beam should hit the target cancer accurately, however the beam must still be aimed very carefully. That role is performed by the fluoroscopy units built into the treatment system. To improve their aiming capability, staff at the Center plan to start replacing the FPDs (flat panel detectors) on all their fluoroscopy systems with Shimadzu Corporation's latest model as early as possible in 2014.

"Using these FPDs to improve the visibility of images will allow us to reduce the exposure levels to patients and technologists," says Fuwa. "Therefore, we will continue to improve performance by increasing the sharpness of images and reducing

Hyogo Ion Beam Medical Center

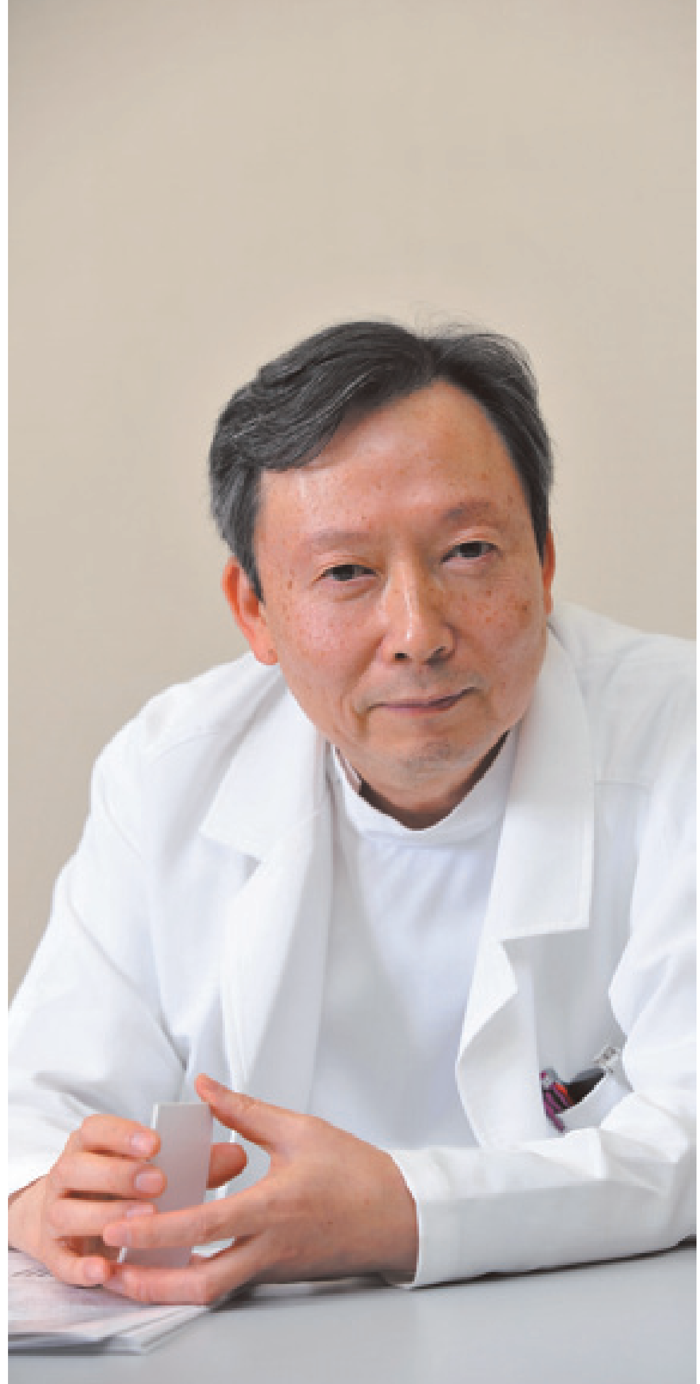
The center was established in 2001 as the first ion beam therapy facility in the world able to use two types of ion beams, either proton or heavy-ion beams. The center treats over 600 patients annually and, as the pioneering ion beam therapy facility, is involved in developing medical devices and cooperating with the Hyogo Ion Beam Medical Support* to assist in establishing additional ion beam therapy facilities.
*Public–private partnership established in Hyogo prefecture



exposure levels."
Now that more people are aware of this facility due to the media and other factors, and have become more informed about the effectiveness of ion beam therapy, the number of patients has been increasing each year. The patients come not only from Hyogo prefecture, but also from throughout Japan. So far the Center has treated over 6000 patients and their reputation as a leader in ion beam therapy is even growing overseas.

Ion beam therapy is especially suited to younger generations

Dr. Fuwa, the director of the center, is a passionate physician. Previously, while he was vice director of the Aichi Cancer Center Hospital, he championed the advantages of ion beam therapy and even proposed having a system installed at the center. Then in 2008, when he learned that a proton beam therapy center was opening in Fukushima prefecture, he took the initiative to apply for a position working there. When he became director of the Hyogo Ion Beam Medical Center in 2012, he used his position and influence as the head of the leading facility in Western Japan to actively state his cause to the government as well.
Currently in Japan, ion beam therapy is considered advanced medical treatment, which means patients must pay for the high treatment costs themselves. However, Director Fuwa points out that there is a different way to think of the costs.
"Consider esophageal cancer, for example. Due to the proximity to the heart and lungs, ion beam therapy is ideal due to its ability to pinpoint the cancer in the body. Nevertheless, the procedure is rarely considered as an option, partly because it is not currently covered by Japanese insurance. However, choosing a procedure with higher risks of adverse side effects can increase medical expenses down the road. In such cases, it may be cheaper to use ion beam therapy in the first place."



He is especially concerned about caring for younger patients. “Due to the long expected life span ahead of them, there needs to be a system that makes it easier for younger patients to receive ion beam therapy, which offers minimal risks of adverse side effects. Unfortunately, current circumstances cause the patient or even their parents to hesitate before paying the high costs for the procedure. Therefore, I think it is the duty of a pioneering ion beam therapy facility such as ours to speak out loudly for changes.”

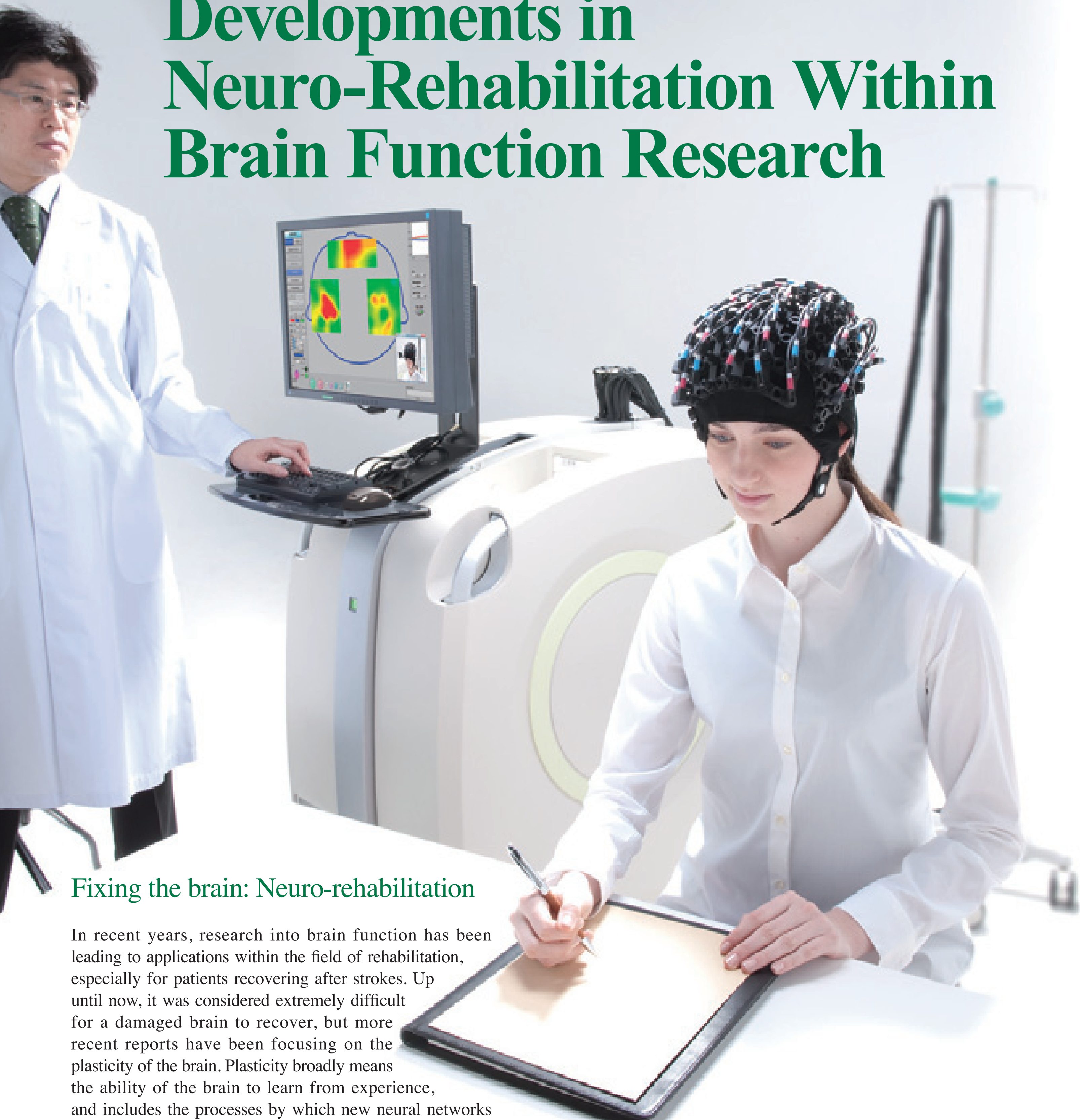
Thanks partly to such efforts by Director Fuwa, Hyogo prefecture has decided to establish Japan’s first ion beam therapy facility designed especially for cancer in children, to be located in the Kobe Biomedical Innovation Cluster area on Kobe’s Port Island. The facility is scheduled to open in 2017. Nevertheless, Director Fuwa’s challenge of acting on behalf of young lives will remain ongoing.

Nobukazu Fuwa

Director of the Hyogo Ion Beam Medical Center
Doctor of Medicine

After graduating from the Faculty of Medicine of Mie University and finishing his residency at the hospital there, Dr. Fuwa worked in the Department of Radiology at the Hamamatsu University School of Medicine, and then, in 1984, worked at the Department of Radiation Oncology, Aichi Cancer Center Hospital. After serving as vice director of that center and director of the Southern TOHOKU Research Institute for Neuroscience, he accepted his current position in April 2012.

Developments in Neuro-Rehabilitation Within Brain Function Research



Fixing the brain: Neuro-rehabilitation

In recent years, research into brain function has been leading to applications within the field of rehabilitation, especially for patients recovering after strokes. Up until now, it was considered extremely difficult for a damaged brain to recover, but more recent reports have been focusing on the plasticity of the brain. Plasticity broadly means the ability of the brain to learn from experience, and includes the processes by which new neural networks are formed in order to help recover damaged brain function. Many groups of researchers have been studying neuro-rehabilitation, which supports the formation of these new neural networks, and their results are now being implemented. This type of rehabilitation requires devices that can provide simple measurements of brain function in study subjects.

Spectroscopic measurements fot rehabilitation

Shimadzu Corporation is contributing to neuro-rehabilitation through its brain-function imaging system LABNIRS, which uses the method of functional near-infrared spectroscopy (fNIRS). fNIRS uses near-infrared light to measure the relative change in hemoglobin within blood flow in the cerebral cortex. When humans are physically active, certain parts of their brain are activated, and a large volume of oxygen is supplied to the brain. At such times, brain activity can effectively be measured by continuously monitoring the changes in hemoglobin.

The unique attribute of fNIRS is its simplicity. Subjects put a holder on their heads, to which optical fiber probes are attached. In contrast to other instruments that measure brain function, fNIRS does not require use of a special measurement room or require the head to be restrained. Preparations for measurement can be completed in around 15 minutes, meaning there is a reduced burden on patients. These attributes make the technique effective for taking measurements in real-life environments, where actual movement takes place, such as regular rehabilitation facilities. Measurements can be taken not only during basic activity, such as when the arms or legs are being moved, but also when using rehabilitation equipment. This sort of measurement is difficult using conventional brain-function measurement systems such as fMRI.

Through fNIRS, researchers are able to obtain real-time information about the brain activity that accompanies actual movement. Since data is acquired as rehabilitation progresses, it is possible to visually ascertain the changes in brain activity as a result of rehabilitation. Being able to show patients their data has the added benefit of maintaining their motivation towards recovery. Furthermore, the easy-to-use benefits of fNIRS make it a valuable tool for neurofeedback research, in which users learn to uniquely activate certain areas of the brain by training with real-time visual displays of their brain activity.

Future developments

In addition to measuring how the brain recovers from damage, researchers are now making progress in trials that fuse brain science and robot engineering to enhance the recovery. The technology that allows external devices to be controlled using thought is known as a brain machine interface or brain computer interface. These systems are currently being used in rehabilitation, and one striking example is the 'Assistance suit' – a support device that can be used by elderly people to assist them with challenging tasks in their daily lives. Such devices can be optimized using brain activity data in order to place an appropriate burden on each individual user. Rehabilitation that is optimized to the individual allows burdens placed on the patient, carer and physical therapist to be reduced. In societies with increasingly ageing populations, this sort of technology is vital for improving the quality of life. In the future, we expect that neuro-rehabilitation will even come to be covered by health insurance.

A fusion of swiftly-advancing computer technology and fNIRS technology can bring the results of brain function research closer to reality. Neuro-rehabilitation looks like being the first step in this process. Shimadzu Corporation provides fNIRS systems to researchers engaged in solving society's problems, with the intention of contributing to future developments in neuroscience and providing solutions for various issues.

fNIRS can visualize a brain activity by measuring a change in hemoglobin volume in real time using near-infrared light.

In the rehabilitation field, fNIRS enables effect measurement by visualizing activated part of a brain and its state.

Enhancing China's medical services

Beijing Shimadzu Medical Equipment Co., Ltd. (BSME) was established in Beijing in 1992 as a manufacturer of medical X-ray diagnostic equipment. BSME's mission is to domestically manufacture X-ray systems tailored to the Chinese medical equipment market, with the aim of reducing costs, shortening delivery times, and, developing new products for that market. Currently, BSME supplies more than 500 systems a year to markets throughout China.

Digitization within the market for X-ray diagnostic equipment in China has been evolving since around 2004. There has been a rapid increase in the demand for replacements for conventional analog equipment. Furthermore, since 2009, under the Chinese government's policies on the healthcare system reform, new hospitals have been opened one after another in order to bridge the gap between medical treatment in urban areas and that of rural areas. Consequently, orders for medical equipment made by government agencies are on the rise. As a result of these two factors, the market for medical equipment in China has experienced a dramatic expansion, and production by BSME has seen major growth.

Not only has BSME domestically manufactured the products that Shimadzu Corporation developed in Japan, they have also developed equipment designed to specifically meet the needs of the Chinese market, based on existing equipment. For example, a general-purpose fluoroscopy system equipped with a flat panel detector was developed independently by BSME. The reaction from users was overwhelmingly positive, and sales of the unit soared. Currently, the focus is on mid-range models, but the lineup will be expanded to include high-end models, as well as mid-to-lower range models in the future.

BSME plans to continue being a partner in China's growth, and aspires toward contributing to the enhancement of the country's medical services. To this end, it is important to identify the needs in China, and keep researching potential future developments with a flexible mindset.

Contributing to Medical Reconstruction in Iraq

Recently, Shimadzu Corporation has been expanding its medical systems business in Iraq, supplying a large number of diagnostic x-ray imaging systems to contribute to the reconstruction of medical care in the country.

Shimadzu has a long historical relationship with Iraq. We were the first Japanese medical systems manufacturer to open a service office in Baghdad, in 1978. At the time, Shimadzu was working on Japanese governmental projects aiming to improve medical care in Iraq, and supplied a lot of systems to public hospitals via Iraq's Ministry of Health.

During the eight years of the Iran-Iraq War, which began in 1980, Shimadzu did not withdraw from Iraq, and maintained its office in the country, providing servicing for systems. As a result, we gained enormous trust both from the Iraqi government and the users of our products. By 1990, we had succeeded in delivering more than 2,000 units of our diagnostic x-ray imaging systems.

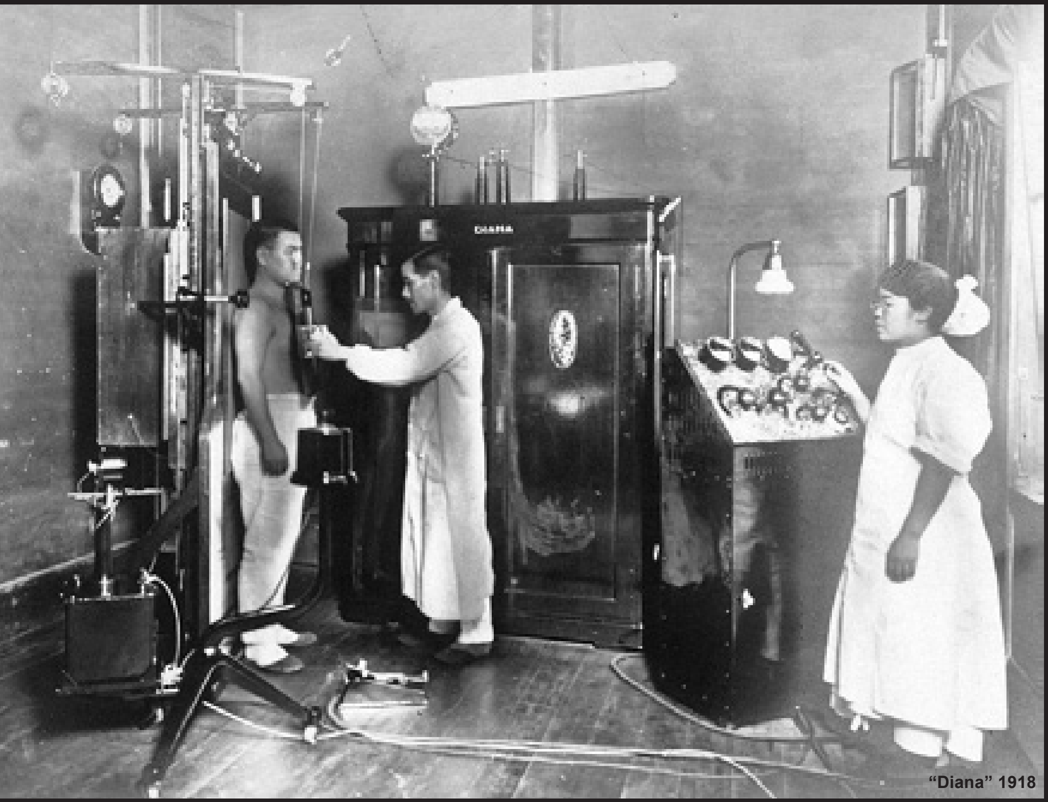
The office was closed with the outbreak of the Gulf War in 1990, at which point we unavoidably had to withdraw, but in 2003, we appointed a local distributor and re-entered the market. Immediately after this re-entry, we were able to implement the renewal of medical systems through the Japanese government's reconstruction and support project. These efforts were well-received, and Shimadzu went on to build up its business in Iraq. In 2006, we delivered 110 units of general radiography systems to the Ministry of Health. In 2007, we delivered 50 mobile X-ray systems, and in 2013, we supplied 106 fluoroscopy systems, among other achievements.

During the approximate 15-year gap between1990 and 2005, during the Gulf War and Iraq War, almost no new medical system was installed in Iraq. As a result, there are still many hospitals that are unable to deliver sufficient medical services to patients. By providing medical systems that enable basic diagnostics to meet immediate local needs, Shimadzu will continue to play a role in supporting the reconstruction of future medical provision in Iraq.

Shimadzu's X-ray fluoroscopy system installed at hospitals throughout Iraq.

As The Pioneer of Medical X-ray Apparatus

Shimadzu X-Ray Systems Contribute to People's Health Around the World



"Diana" 1918

The challenge of producing medical X-ray systems in Japan

The history of Shimadzu X-ray systems began almost 120 years ago. On October 10, 1896, Professor Hanichi Muraoka of the Third High School (now Kyoto University), and his assistant Sosuke Kasuya, successfully produced an X-ray photograph at Shimadzu's laboratory. This was achieved with the help of Genzo Shimadzu Jr. and his younger brother Genkichi after a great amount of hard work and effort. This occurred just eleven months after the discovery of X-rays by Dr. Roentgen. Shimadzu obtained the necessary knowledge and technology to manufacture X-ray systems as a result of this original work. Instead of being satisfied with the successful results of this experiment, Shimadzu started to work on practical uses for X-ray apparatus and developed an educational X-ray apparatus the following year (1897). Shimadzu's next goal was to manufacture medical X-ray systems in Japan. In order to break away from depending on expensive medical X-ray systems imported from other countries, Shimadzu began their own research and development to manufacture an X-ray system for use in Japan. Through a series of trials and errors, including improvements to the induction coil, Shimadzu completed the first Japanese medical X-ray apparatus in 1909. This system, which used a benzene generator to charge a storage battery and generate power, was delivered to a hospital in Chiba Prefecture. Two years later in 1911, Shimadzu developed Japan's first alternating current X-ray system and delivered it to the Japan Red Cross Hospital. As a result, Shimadzu established itself as a pioneer in medical X-ray systems in Japan.

Releasing successful products and exporting them

In the late 1910s, X-ray apparatus started to become more commonly used in Japanese medical facilities. In order to meet the growing demand for X-ray apparatus, Shimadzu released the DIANA, AURORA, and NEW AURORA with Coolidge X-ray tubes in 1918; the most advanced technology at that time. They were all well-received by people working in medical facilities because they were easy to operate. They dominated the Japanese X-ray apparatus market and were also exported to other countries. Exporting this advanced X-ray apparatus just nine years after designing its first X-ray machine demonstrated Shimadzu's expertise in science and technology.

Shimadzu kept developing new apparatus and became the number one medical X-ray system manufacturer. Shimadzu released the JUPITER, an apparatus for deep therapy in 1922; POLESTAR and DUNO which used a high-voltage rectifier made by GE in 1924; and DAIGO, a portable system which was a precursor of electric shock preventive systems, in 1931. Shimadzu also focused on training X-ray technologists and developing radioactive medicine. From 1921, Shimadzu held X-ray seminars for 20 years and established the Shimadzu X-Ray Technology Training Center in 1927 with the approval of Kyoto Prefecture. The Training Center developed into the four-year college Kyoto College of Medical Science from which 4000 students have graduated to date.

Aiming to become the world's number-one company in digital technology

In 1961, when Japanese society had finally started to recover from the devastation of World War II, Shimadzu jointly developed the world's first remotely controlled fluoroscopy system with an electric appliance manufacturer, meaning that X-ray technologists could perform all operations from a different room. This provided an environment where technologists could safely focus on their work without being exposed to radiation. Five years later, Shimadzu created a small-sized apparatus that could be operated by a doctor.

As X-ray systems became more and more digitized, Shimadzu carried out research and development to produce a direct-conversion flat panel detector (FPD). Creating new frontiers in this research area, Shimadzu chose to use amorphous selenium as a conversion layer material even though all major manufacturers in other countries had their doubts about it. After overcoming a great number of difficulties, Shimadzu successfully developed the detector and mounted it on cardiovascular X-ray systems in 2003.

In 2005, Shimadzu released the MobileDaRt mobile X-ray system with a wireless FPD. The system allows medical staff to perform radiography and view images wherever necessary, meaning that it is now used at emergency sites, disaster sites, and newborn intensive care units where highly urgent care is required. Shimadzu also continues to develop innovative digital systems and support the health of people in many countries and regions all over the world.

1896
Succeeded in taking X-ray pictures (First in Japan).

1909
Built Japan's first medical X-ray apparatus.

1911
Large-size medical X-ray apparatus (First in Japan).

1918
X-ray apparatus "Diana" and "New-Aurora".

1931
Portable X-ray apparatus "Daigo", the full shockproof X-ray unit.

1932
Diagnostic X-ray apparatus "Katsura".

1941
Mass screening car with X-ray apparatus mounted.

1961
Remote-controlled X-ray R/F system (First in the world).

1990
Developed the elevating remote-controlled casetteless R/F system "SHIMAVISION 3500" (First in the world).

2003
Developed digital cardiac system "HeartSPEED safire" incorporating direct-conversion FPD (First in the world).

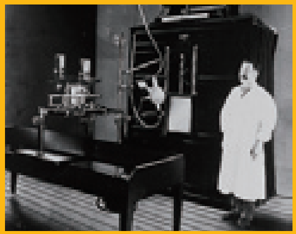
2004
Developed digital table system SONIALVISION safire which is tomosynthesis option available and general radiography system RADSPEED safire, incorporating 17x17-inch direct-conversion FPD first in the world.

2006
Developed digital table system SONIALVISION safire II and digital Cardiovascular system BRANSIST safire.

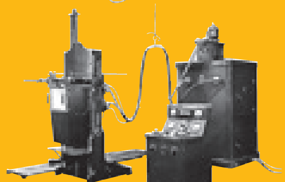
2007
Developed digital angiography system BRANSIST safire incorporating 17x17-inch direct-conversion FPD.

2008
Developed digital radiographic mobile X-ray Mobile DaRt evolution.


Radiographs taken at Shimadzu


Japan's first large X-ray apparatus


"Daigo"


"Katura"


X-ray car


Remote-controlled X-ray R/F system


ZS-35 "SHIMAVISION 3500"


SONIALVISION safire

MobileDart


The publication of the Physics and Chemistry Instrument Catalog

In a rapidly-changing environment, Genzo Shimadzu Sr. worked steadily to establish his work with physics and chemistry instruments. Six years later, he renovated and expanded the factory. The following year, he published the Science Equipment Catalog List, a catalog of physics and chemistry equipment. This catalog was organized into five sections — physical properties and solids, water and gases, sound, heat and light, and magnetism and electricity. It also indicates that approximately 110 physics instruments, and also models, chemistry instruments, medical instruments, various pumps, and cast products were available for manufacture. At the end of the catalog, it also states that Shimadzu would manufacture anything the customer desires, as is still expressed by our motto “Best for Our Customers.”

This catalog, which is currently on display at the Shimadzu Foundation Memorial Hall, shows the types of physics and chemistry instruments that were being used in the physics departments at the University of Tokyo, and elsewhere, in the early Meiji Period (around 1870). It also shows how Shimadzu offered almost all the laboratory instruments and equipment necessary for teaching physics or chemistry in early Meiji Japan. Therefore, this catalog is of great historical and academic importance.

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