

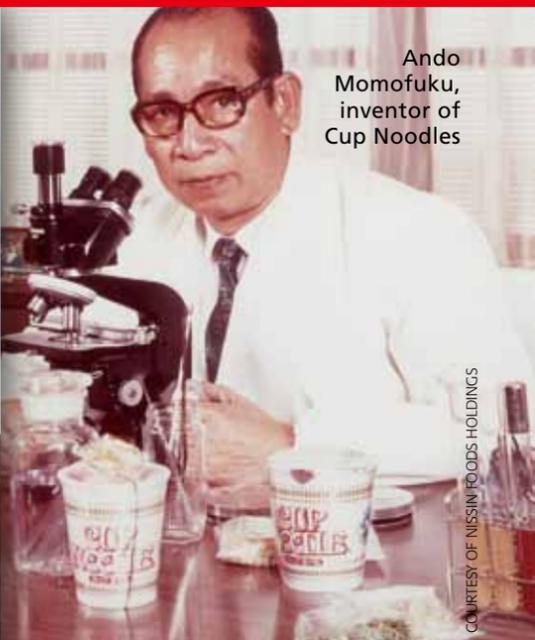
LED lights



Flexible structured buildings



Ando Momofuku, inventor of Cup Noodles



COURTESY OF NISSIN FOODS HOLDINGS

100 Postwar Japanese Innovations

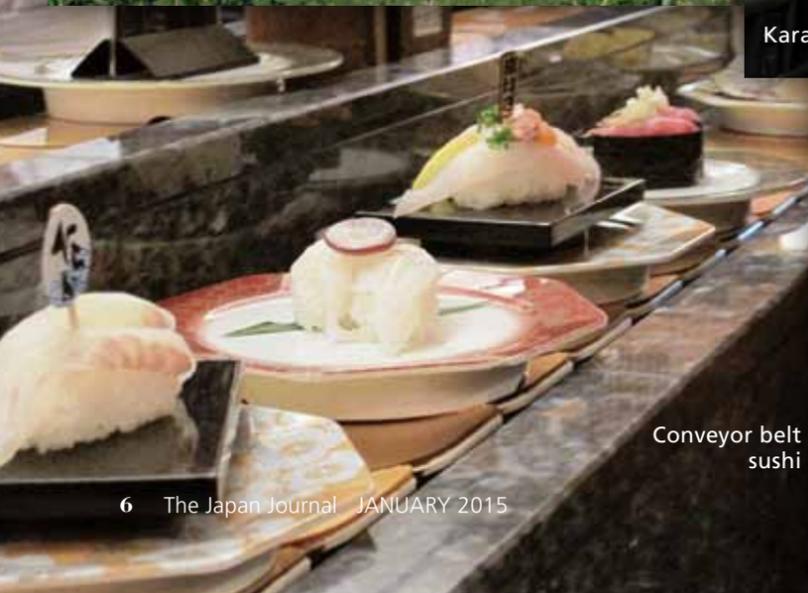
Fuji apples



Karaoke



Conveyor belt sushi



Automatic ticket gate systems for train stations



In July of 2014, the Japan Institute of Invention and Innovation (JIII) announced its initial round of selections for the list of “100 Postwar Japanese Innovations.” Innovations chosen in this round included many which have not only helped to fuel economic growth in postwar Japan but also had considerable impact worldwide. We introduce some of these landmark innovations.

According to the World Instant Noodles Association, global demand for instant noodles reached about 105.6 billion servings in 2013, or roughly fifteen servings for every person on the planet. The Chinese market ranked first at 46.2 billion; Indonesia second at 14.9 billion, and Japan third at 5.5 billion. Korea topped the per capita consumption list, its people eating 72 servings each on average in 2013.

Invented by Ando Momofuku, founder of Nissin Food Products, in 1958, instant noodles are already one of the world’s most popular instant foods and can truly be described as an innovation that changed the world’s gastronomic lifestyle. When the Japan Institute of Invention and Innovation (JIII) surveyed the public as part of its efforts to determine and rank the “100 Postwar Japanese Innovations,” instant noodles came in one of the top three slots (see table p. 9).

Ando began his work to develop instant noodles in 1957. He had just lost all of his personal assets through a business failure. One of the factors influencing Ando’s decision to work on the development of instant noodles after he got back on his feet was the memory of scenes he’d witnessed following the Second World War. In the immediate postwar period, the need for food in Japan was so desperate that people were actually starving to death. One winter’s night, Ando saw that a long queue of customers had formed in front of a stall selling noodles near the fire-gutted shell that the bombing during the war had left of Osaka Station. He then realized that he could make a lot of people happy if he could just invent a kind of noodles that anyone could prepare easily.

Ando had tried his hand in various enterprises before and after the war but had no experience in the noodle business. He built a little work shed for his research in the garden of his house and immersed himself without a break from morning to night in solitary research. He focused his research efforts in par-

ticular on the development of drying methods needed to preserve noodles over time. Simply drying them with heat or air resulted in noodles which failed to soften adequately when hot water was added. But after observing his wife deep frying tempura once, he hit upon the method of drying noodles by deep frying them in oil. The drying method relies on a principle whereby the temperature difference between the water and

age in a bowl and adding hot water and a lid. The product was sensationally popular in no time. Chicken Ramen’s popularity was heightened further by sales and advertising channels never before seen in Japan. These mass sales were accelerated via supermarkets, which were just getting started in Japan, as well as commercials on new broadcast media such as television, which was also just starting to gain popularity.

A variety of other companies attempted to piggyback on Chicken Ramen’s success by unveiling a veritable train of products on the market imitating both the name and package design of Chicken Ramen. However, the great majority of these were poor in quality. Aiming to popularize high-quality instant noodles, though, Ando abandoned his patent monopoly. He made public the manufacturing method protected under his patents on noodle drying and flavoring, resolving instead to license the process to other companies. He said at the time that it would be better to develop as a forest rather than stand alone as a single tree in a field by maintaining sole control over the process through patents held by Nissin Food Products.



COURTESY OF NISSIN FOODS HOLDINGS

Chicken Ramen, which went on sale in 1958

the oil removes the moisture from the noodles. It also creates innumerable small pores in the noodles after the water is removed. Moisture is drawn in through these pores when hot water is added, resulting in noodles of just the right softness. Ando then developed a means of adding flavor to the noodles using a broth extracted from chicken. Just add hot water to the noodles and you have a Chicken Ramen meal, steaming with a chicken broth aroma.

After it went on sale in 1958, Chicken Ramen became known as “magic noodle” because consumers could sit down to a delicious meal just three minutes after emptying the pack-

Determined to popularize Chicken Ramen worldwide, Ando visited the United States in 1966 to conduct market research. When he asked grocery shoppers at a supermarket to try Chicken Ramen, he noticed that they broke it into small chunks which they would drop into a cup and eat with a fork after adding the hot water. It then struck him that Westerners don’t use chopsticks or generally eat out of bowls. But if the noodles were sold in a container from the start, no bowl would be needed. This became the insight which gave rise to the Cup Noodles products containing instant ramen in a cup-shaped container. After solving various problems relating to the ingredient drying process and the shape and material for the container and lid, Nissin Food Products began selling Cup Noodles in Japan in 1971. The product went on sale in the United States in 1973,

Cupnoodles Museum

You can select up to four toppings from the twelve ingredients.”
“All right then, I’ll take shrimp, eggs, garlic chips and corn.”

Having noted the gentleman’s preferences, the assistant at the counter deftly scoops up several freeze-dried ingredients with a spoon and drops them into a Cup Noodle container.

The venue is the My Cup Noodles Factory, one of the leading attractions at the Cupnoodles Museum in the Minato Mirai district of Yokohama, Kanagawa Prefecture. Visitors can prepare their own custom Cup Noodle meal here for just 300 yen. Visitors first draw their own unique design on the outside of the special-purpose cup with a colored pen. Then, they turn the handle on a noodle dispenser to add the noodles. That done, they choose one of four powdered soups and four of twelve ingredients. The assistant at the counter then adds a lid and shrink wrapping. The finished cup is then placed in an air-cushion bag ready to be taken home.

Formally known as the Momofuku Ando Instant Ramen Museum, the Cupnoodles Museum opened its doors in 2011. It offers many attractions that allow visitors to experience the creative thinking of Ando Momofuku (1910–2007), who founded Nissin Food Products and invented Chicken Ramen, the world’s first instant noodles that consumers could prepare just by pouring hot water over the noodles. Ando also originated Cup Noodles, the world’s first noodle meal sold in a cup.

Next to the My Cup Noodles Factory is the Chicken Ramen Factory, where visitors can make Chicken Ramen from the earliest stages of kneading the flour and forming the noodles. Other attractions include a faithfully recreated life-size model of the work shed where Ando conducted his research to develop Chicken Ramen, as well as a little indoor playground modeled on the Cup Noodles factory which is a hands-on facility where they can experience the noodle-making process from sifting the flour to shipping the products.

Throughout the year, the museum bustles with groups of elementary, middle and high school students on extracurricular outings or field trips, as well as families and foreign tourists.

All told, more than 3 million people have visited the museum since its opening just three years ago.

TJJ



Visitors select their own Cup Noodle ingredients at the My Cup Noodle Factory housed within the Cupnoodles Museum at Minato Mirai in Yokohama, Kanagawa Prefecture.



The Cupnoodles Museum has on display a model of the work shed which Ando built to conduct his research for Chicken Ramen.

after which it spread worldwide, transcending a diversity of culinary lifestyles. Today, Cup Noodles are sold in over eighty countries and regions.

“We have local subsidiaries in countries all over the world, but each one of these works to develop instant noodles suited to the tastes of local people,” says Okabayashi Daisuke of Nissin Foods Holdings Corporate Communications Division. “We anticipate further demand in developing countries, which are seeing rapid economic growth. As economies grow, people’s lives get busier, so they have correspondingly less time for cooking. That means rising demand for instant noodles.”

Instant noodles are easy to prepare and keep a long while, so in times of natural disasters they are often shipped

as a component of relief packages to disaster-affected areas. When the Great East Japan Earthquake struck in March of 2011, Nissin Foods Holdings provided 2 million servings of instant noodles to the disaster-affected areas. The World Instant Noodles Association, which was launched in 1997 at the initiative of Ando Momofuku and now has more than 170 member companies and organizations worldwide, sends instant noodles to people elsewhere in the world in times of major natural disasters, as it did following the Sumatra-Andaman Earthquake of 2009, the Haiti earthquake in 2010 and the Philippine typhoon of 2013.

“Some of the victims of the Great East Japan Earthquake told us they were greatly relieved to be able to have a cup

of hot noodles,” recalls Okabayashi. “Instant noodles aren’t junk food; they have high nutritional value. We’re convinced they can contribute to resolving world food problems.”

Great Inventions

The Second World War took many lives and left Japan in a state of ruin. Nevertheless, Japan’s economy began recovering quickly from the 1950s such that by 1968 the nation was the second ranking economic power in the world by GDP. Many innovations contributed to Japan’s development in the postwar era. A diversity of revolutionary products and business models forged in Japan spread beyond the home front to other countries, helping to improve people’s lives.

100 Postwar Japanese Innovations

Public Survey Results

- **Endoscope** (1950): Olympus Optical (now Olympus) developed a gastrocamera to take images inside the stomach, the world’s first practically applicable gastrocamera.
- **Instant noodle** (1958): Ando Momofuku, founder of Nissin Food Products, developed Chicken Ramen, the world’s first instant noodle product.
- **Manga/Anime** (1963): *Tetsuwan Atomu* (Astro Boy) was first broadcast in Japan in 1963, sparking worldwide demand for manga (Japanese comics) and anime (Japanese animation).
- **Shinkansen** (1964): Shinkansen (new trunk line) bullet train services were launched by Japan National Railways (now JR), as the part of the world’s first high-speed inter-city rail system.
- **Toyota Production System** (1970): Production system developed by Toyota Motor, revolving around *jidoka* (automation with a human touch) and the “Just-in-Time” (JIT) system
- **Walkman** (1979): Compact stereo cassette tape player developed by Sony
- **Washlet** (1980): Toilet seat with warm-water washing feature, developed by TOTO KIKI (now TOTO)
- **Home video game console/game software** (1983): Nintendo launched the Family Computer (Famicom) home video game console in 1983. It took off all over the world, due in part to the popularity of games such as Super Mario Bros.
- **Light emitting diode** (1993): Light emitting diodes (LED) are semiconductor crystals that emit light under an electrical current. The Japanese scientists who contributed to the commercialization of the blue LED were awarded the Nobel Prize in Physics in 2014.
- **Hybrid car** (1997): Developed by Toyota Motor, hybrid cars have engines that are powered by two different sources, namely an internal combustion engine and an electric motor.

Additional innovations from the postwar recovery period to rapid economic growth period (1945-1974)

- **Fish finder** (1948): Furuno Electric Industries (now Furuno Electric), founded in Nagasaki Prefecture, became the first company in the world to develop a commercial fish finder.
- **Welding method and block construction method** (1949): Shipbuilding method that simplified construction and ensured accuracy, underpinning the Japanese shipbuilding industry as a whole
- **Ferrite** (1951): Invented by researchers at the Tokyo Institute of Technology, ferrite was later commercialized by Tokyo Denki Kagaku Kogyo (now TDK). It is used as a material in magnetic heads of tape and video recorders and magnetic tapes.
- **Fastener** (1952): Yoshida Kogyo (now YKK) developed a unique fastener production technology, based on technologies from the USA and Germany, enabling high quality fasteners to be manufactured at low cost.
- **Integrated steel production facility** (1953): Integrated steel production facility that combined every part of the process, from iron and steel production to casting and rolling, enabling mass production of a wide range of iron and steel products
- **Electric rice cooker** (1955): Tokyo Shibaura Electric (now Toshiba) developed Japan’s first electric rice cooker, a device that went on to become a common fixture in people’s homes.
- **Transistor radio** (1955): Radio commercialized by Tokyo Telecommunications Engineering (now Sony) using transistors developed in the USA
- **Koshihikari** (1956): The most popular variety of rice in Japan, Koshihikari has been the country’s most widely cultivated rice since 1979.
- **Conveyor belt sushi** (1958): *Kaiten-zushi* restaurants serve customers sushi via a conveyor belt. “Genroku Zushi” was the first restaurant of its kind, opened in Osaka.
- **Kumon method of learning** (1958): Developed by Kumon Toru, the Kumon method is based on self-learning, focusing on learning content and individualized

instruction. It has since spread to 48 countries and regions around the world.

- **Compact (light) cars** (1958): Fuji Heavy Industries played a pioneering role in popularizing the motor car with the launch of the “Subaru 360,” a compact car with a 360 cc engine.
- **Super Cub** (1958): A 50 cc motorcycle launched by Honda, the Super Cub is now sold in around 160 different countries and regions worldwide.
- **Yamaha Music School** (1959): A music school for regular people set up by Nippon Gakki (now Yamaha), there are now Yamaha Music Schools in over 40 countries and regions around the world.
- **Fuji apples** (1962): One of the representative varieties from Japan, Fuji apples account for 20% of worldwide apple production and the world’s largest output by variety.
- **Synthetic leather** (1964): Products such as Kuralino, developed by Kurashiki Rayon (now Kuraray), and Ecsaine, developed by Toray, became international hit products, offering the same performance as natural leather but in a synthetic product
- **Desktop electronic calculator** (1964): The period from the 1960s through the 1970s saw fierce competition between Japanese companies such as Sharp and Casio as they vied to develop desktop electronic calculators that were smaller and more affordable.
- **Head-feeding combine harvesters and rice-planting machines** (1965): Rice planting, harvesting and husking became increasingly automated during the 1960s and into the 1970s, saving farmers both time and effort, as well as increasing yields.
- **Karaoke** (1967): Based on singing along to pre-recorded backing tracks, karaoke swept Japan during the 1970s and went on to become popular the world over.
- **Automatic ticket gate systems** (1967): Whereas staff used to clip passengers’ tickets at stations throughout Japan, the introduction of automatic ticket gate systems substantially reduced crowding at ticket gates.
- **Flexible structured buildings** (1968): The advent of flexible structured buildings capable of absorbing shocks from earthquakes paved the way for a steady stream of high-rise buildings in Tokyo, starting with the Kasumigaseki Building.
- **Automatic mail processing equipment** (1968): Toshiba developed and trialed the world’s first hand-writing recognition system in 1967, and went on to install a machine to automatically sort letters at Tokyo Central Post Office the following year.
- **Introduction of LNG** (1969): Imported from Alaska in 1969 as a low environmental-impact alternative to oil and coal-based fuels, the world’s first LNG (liquefied natural gas) power plant went online in Yokohama in 1970.
- **Quartz wrist watch** (1969): Seiko launched the world’s first quartz wrist watch, using a quartz crystal unit that harnessed the oscillations occurring in crystals under an electrical current.
- **Cathode-ray tube (CRT) television** (1960s): Whereas overseas manufacturers had led the way with black and white televisions, Japanese companies surged ahead when it came to developing color televisions. By the 1970s, Japan was the leading worldwide exporter of televisions.
- **Desulfurization, denitration and dust collection systems** (1960s–70s): Although Japan had suffered from chronic air pollution during the 1960s, the development of desulfurization, denitration and dust collection systems made a huge difference in terms of improving air quality.
- **Field-emission electron microscope** (1972): Hitachi commercialized the field-emission electron microscope, which significantly improves magnification compared to optical microscopes, based on an idea from an American researcher.
- **CVCC engine** (1973): Developed by Honda, the CVCC engine was the first low-pollution engine in the world to clear USA emission standards, an achievement that was thought to be impossible at the time.
- **Convenience stores** (1974): The convenience store business model was imported from the USA to Japan, where it grew into a massive industry.

To mark the 110th anniversary of its founding, the Japan Institute of Invention and Innovation (see **box** p. 10) launched a program to identify “100

Postwar Japanese Innovations” which had contributed significantly to the development of Japan’s industry and economy in the postwar era. The selec-

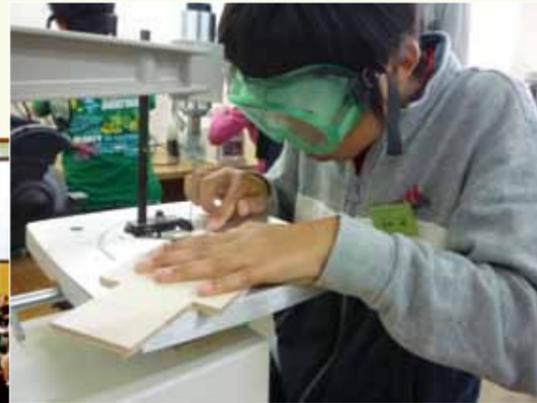
tion committee, chaired by Hitotsubashi University Professor Emeritus Nonaka Ikujiro, announced the first group of thirty-eight innovations in July of 2014.

Japan Institute of Invention and Innovation

The Japan Institute of Invention and Innovation (JIII), which in 2014 celebrated the 110th year since its founding, works to encourage and promote invention, nurture and develop youth creativity, and promote the intellectual property rights system. JIII's current chairman is Shoyama Etsuhiko. In one program aimed at encouraging and promoting invention, JIII has since 1919 distributed National Invention Awards to recognize persons who have originated outstanding, highly creative inventions as well as persons who have contributed to the encouragement of inventions. Programs which JIII conducts in order to foster creativity in young people include the Concours of Schoolchildren's Inventions and the Exhibition of Children's Art/Tomorrow's Science, which are aimed at whetting children's appetite for science. Extracurricular activities supported by JIII include Invention Clubs for Schoolchildren, through which children can try their hands at inventing and handicrafts. JIII programs aimed at promoting the intellectual property rights system include measures to prevent counterfeiting and outreach to international intellectual property organizations.



TJJ National Invention Awards 2014



A primary school boy at work in one of the JIII-sponsored Invention Clubs for Schoolchildren

"It's commonly understood in Japan and indeed all over the world that innovation is critically important for future economic development," says Oikawa Kozo, vice chairman of JIII. "A major goal of this event is to help promote future innovation by highlighting the most outstanding innovations Japan has introduced to date."

Experts disagree about what innovation is precisely, but for the purposes of the JIII project, it can be defined as "an undertaking, ultimately economic in nature, which by creating something new brings about major historical and social change that either develops beyond national borders or has the potential to do so. It may include not just inventions but business models or projects, and may also include inventions which, though originating outside of Japan, have been substantially developed within Japan."

In considering the definition of innovation, the selection committee stressed creativity, historical importance, and international potential. For example, an innovation may also include something which a foreign company may have patented but which a Japanese company has used to develop markets in

Japan and abroad.

In making the selections, JIII first conducted a survey of lay people through the Internet, setting the condition that one person could nominate up to ten innovations. Some 2,286 people submitted responses. JIII then sent a questionnaire to researchers at universities or research institutes and industry organizations in a variety of sectors and received responses from a total of fifty-one individuals and organizations. The responses were first ranked according to which innovations received the largest number of votes, the top ten being select-

ed according to the number of votes received. Overwhelmingly, the Shinkansen, instant noodles and the Walkman received the most votes for the top three slots.

In selecting candidates for rankings below the top ten, the selection committee referred not only to the number of votes a candidate innovation received in



The TR-55, Japan's first transistor radio, made by Tokyo Telecommunications Engineering Corporation (now Sony Corporation) in 1955

COURTESY OF SONY

the questionnaire but also to academic and expert opinion and to any prestigious awards which the innovation might have received. Based on these criteria, the committee then chose twenty-eight additional innovations from the postwar recovery period (1945–1954) through Japan's period of rapid economic growth (1955–1974).

"There's a great deal of diversity among the thirty-eight innovations, so it's hard to put a finger on the defining feature underlying Japanese innovations," says Oikawa. "But my own view is that one such characteristic for some time after the war was the Japanese eagerness to adopt foreign technologies and ideas and then develop them in the full range of their possibilities. In recent years, however, the lion's share of Japanese innovations are truly unique technologies."

The transistor radio is an example. Transistor technology was developed in the United States at Bell Labs in 1948. Technical problems with the transistor shortly after it was invented had to be surmounted before it could be used in radios. In 1953, a seven-year-old Japanese venture company called Tokyo Telecommunications Engineering Corporation (now Sony Corporation) entered into a patent licensing agreement with Western Electric, the parent company of Bell Labs, to manufacture transistors. By 1955, Tokyo Telecommunications had succeeded in developing and putting on sale the TR-55, Japan's first transistor radio. In 1957, the company introduced the world's smallest radio, the TR-63, which became a hit product not just in Japan but the United States as well. The development of the transistor radio signaled Sony's debut on the world stage as a global company and gave it the initiative in the electronic products miniaturized by transistors.

Convenience stores provide an example of one way in which Japan has



Japan's first 7-Eleven store opened in 1974 in Koto Ward, Tokyo

COURTESY OF SEVEN AND I HOLDINGS

adopted and significantly developed a retail business model created in the United States. Convenience stores got started in Japan after the middle-tier supermarket chain Ito-Yokado entered into a business tie-up with the American company Southland Corporation and in 1974 opened the first 7-Eleven store in Tokyo's Koto Ward. The number of stores then grew apace, and a variety of other companies entered convenience store business in turn. Japanese convenience stores continued to make progress by developing a series of unique products and services which American convenience stores lacked. According to data from the Japan Franchise Association, the number of convenience stores in Japan reached 51,000 by October of 2014, with aggregate net sales totaling roughly 8,500 billion yen in 2013. Japanese convenience store operators are now taking their business to other countries, mainly in Asia.

In recent years, Japan has made stunning advances in basic research. One example is induced pluripotent stem (iPS) cell technology, which was excluded from the selection process this round but received enough votes to rank one of top three in the surveys were it to have been included.

Able to differentiate into any type of cell in the body, iPS cells were successfully pioneered for the first time anywhere in the world by Professor Yamanaka Shinya of Kyoto University in 2007. Professor Yamanaka was awarded the Nobel Prize in Physiology or Medicine in 2012 for his work. Given the

great potential which iPS present for the field of regenerative medicine, research is underway in countries around the world. In the first attempt anywhere in the world to use iPS cells in regenerative therapy, doctors at Japan's Institute of Physical and Chemical Research (RIKEN) in September of 2014 performed surgery in clinical trials to transplant iPS cells

to patients suffering from age-related macular degeneration, a serious condition. However, despite its great potential as a revolutionary technology developed by Japanese scientists, iPS cell technology remains in the development stage. As a result, the JIII selection committee decided to exclude it from the selection process this time round.

Over the next few years, JIII will work to select the best innovations starting from and after 1975 while considering additions to the list of innovations through 1974.

One strong candidate for inclusion in the lists to be drawn up in the future is liquid crystal technology. Research on liquid crystals made advances in Europe and the United States, but Japanese companies played a major role in commercializing liquid crystal technology for use in liquid crystal displays and flat panel televisions. Other candidates include Japan's energy-saving technologies.

"Choosing the best innovations is by no means easy," says Oikawa. "But the effort is very worthwhile for the future of Japan and the world. Someday, we hope to establish an "innovation hall of fame" to honor the most outstanding innovations.

Endoscopes Saving Lives

The great majority of the innovations selected for inclusion among the 100 Postwar Japanese Innovations continue to evolve. One of these is the endoscope. The endoscope was developed in 1950, or during the earliest period covered in

The Model GT-I, which Olympus Optical Co. (now Olympus) developed in 1952 as the world's first practical-use gastrocamera



COURTESY OF OLYMPUS

type gastrocamera was finished in 1950. The Gastrocamera was a small camera with a miniature lens using 5 mm-wide black-and-white film and a 5 mm-diameter light bulb at the tip of a soft tube 12 mm in diameter. It was also designed so the doctor could manipulate a control section by hand to work the flash and wind the film.

Two years after the completion of the prototype, Olympus in 1952 put on the market the world's first gastrocamera for practical use, the "Gastro-Camera GT-I." The Gastrocamera Research Group based mainly at the University of Tokyo Main Hospital was subsequently launched. Thanks to the contribution of these physicians, progress was achieved in the effort to develop gastrocameras that could be used in clinical practice.

In this way, gastrocameras came into wider use in Japan from around the middle of 1950. One disadvantage of the camera, though, was that physicians could not view the inside of the stomach in

real time. This problem was solved in 1957 when optical fiber was used to develop fiberscopes in the United States. Fiberscopes made it possible to view the inside of the stomach directly. Nevertheless, the fiberscopes developed in the United States had poor visual resolution and were therefore not suitable for use by physicians making diagnoses. Olympus then developed a gastrocamera fiberscope in 1964. The clear resolution of the instrument won plaudits from doctors all over the world. The company continued its efforts to develop endoscopes, broadening its market not only in Japan but overseas as well.

Cooperation from physicians is indispensable in the development of endoscopes. Through close communication with physicians, the Olympus engineers determine the precise needs of users regarding such parameters as controllability and image viewing methods and

then develop instruments that meet those needs. The ties built up among physicians since the development of the first gastrocameras have been directly related to the techniques Olympus uses to produce top-quality endoscopes. Endoscopes for medical use include rigid endoscopes, in which the portion inserted into the body is made of hard metal, and flexible endoscopes, in which it is flexible. Olympus presently holds 70 percent of the global market in gastrointestinal endoscopes (flexible).

"In the initial period after we commercialized them, gastrocameras were much more of a niche market for us compared to such products as conventional cameras and microscopes," says Yamaoka Masao, manager of the Corporate Planning Department of Olympus Medical Systems Corporation. "Since the 1990s, though, endoscopes have grown into one of our main business lines as endoscopic treatment have advanced."

One field of technology that has been evolving since the 1970s is endotherapy. Initially, endoscopes could only be used to view internal organs, but since the late 1960s, a variety of new endotherapy devices passed through the body of the endoscope to emerge from the distal end have enabled physicians to carry out a wide range of endoscopic treatments, such as tissue collection, excision of diseased tissue, and arresting of bleeding from excision wounds.

The most significant benefit of endoscopic treatments is the reduction in the level of stress on the bodies of patients and examination subjects. In other words endoscopic treatments are minimally invasive. In early stage stomach or colon cancer, for example, the malignancy can now be removed without opening up the abdomen since surgeons can use flexible endoscopes together



The distal end of an endoscope which Olympus put on the market in October of 2014.

COURTESY OF OLYMPUS



Videoscopes fitted with imaging devices at the distal end are today the leading type of flexible endoscopes for examination and treatment of organs such as the stomach and colon.

the selection process based on the number of votes cast.

Endoscopes are medical instruments used to view organs inside the body. Their history is said to extend all the way back to ancient Greece. But the roots of modern endoscopes lie in the light conductor technology developed in 1805 by the German physician Philipp Bozzini. The technique involves inserting a metal tube into the urethra, the rectum, or the pharynx to make observations using light from a lamp. German and French doctors had developed instruments to view the inside of organs such as the stomach, the urethra and the bladder, but since patients suffered such great pain in the process, they never became widely used as medical devices.

Then one company developed a gastrocamera with genuinely practical value as a medical instrument for the first time anywhere in the world. Even today it continues to make significant contributions to the development of modern endoscopes. That company is Olympus Optical Co. (now Olympus Corporation). It all began when Olympus received a request from Dr. Uji Tatsuro of the University of Tokyo Branch Hospital in 1949. At the time, a large number of Japanese patients suffered from stomach cancer. However, no



COURTESY OF OLYMPUS

Dr. Uji Tatsuro (center) conducts clinical tests using a gastrocamera.

means existed at the time to detect stomach cancer in its early stages, so surgical intervention most often did little to halt the advance of the cancer. Dr. Uji realized that detecting stomach cancer early would be possible if a camera could be used to view the inside of the stomach. He therefore appealed to Olympus, a well known camera manufacturer, to develop one.

However, Olympus engineers faced a host of difficulties in their attempt to develop gastrocameras of such unprecedentedly small size, or small enough to be inserted into the stomach to view it without causing great distress to the patient. For example, one difficult problem was developing a miniature flashbulb that could flash brightly more than twenty times in the dark interior of the stomach. Dr. Uji and the Olympus engineers nevertheless worked together to overcome these problems, until a proto-

with various endotherapy devices. In an increasing number of cases, moreover, doctors are performing operations such as laparoscopic and thoracoscopic surgery by making an incision of just a few millimeters and deploying rigid endoscopes into the abdominal or chest cavity. In the past, such operations would have required opening up the chest or abdominal cavities ten centimeters or more. Physicians can therefore now choose from a much wider range of treatment modalities. Wounds caused by endoscopic surgery are small, and the resulting pain is correspondingly reduced. The recovery process is quicker as well.

"Endoscopic treatment is now one of the leading forms of treatment for early stage stomach and colon cancer all over the world," says Yamaoka. "Given their contribution to early diagnosis and minimally invasive treatments, I think endoscopes have certainly helped improve the quality of life for a great number of people."

Endoscope imaging technologies have also been making progress, and it is now much easier for physicians to detect lesions. One of these technologies is narrow band imaging (NBI), which Olympus became the first company in the world to develop in 2006. Malignant and other tumors create capillaries on the surface of mucosa in order to draw in the large amounts of blood needed to feed the tumor's proliferating cells. Hemoglobin in blood readily absorb blue-wavelength light, so a physician

can shine a beam of blue-wavelength light from the distal end of an endoscope to light up these mucosal capillaries in blue, causing them to stand out. This makes it possible to detect cancer and other lesions. Before the development of NBI, physicians stained the affected area in order to see the capillaries on the surface of the mucosa. With NBI, however, the physician need only engage a switch on a handy control section to change the wavelength of the light, making more efficient examinations possible.

"Advances in endoscopy don't proceed in spectacular leaps, but I think it's important that we continue working hard to develop instruments that can contribute to early detection and minimally invasive treatments," says Yamaoka. "Together with our partners in engineering and other fields, we're committed to the task of achieving ever-higher resolutions to make it as easy as possible for physicians to detect cancer and other lesions." ■

SAWAJI Osamu, *The Japan Journal*