

KEK News

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Message from the Director General at the beginning of 2007



As this is a year of Boar, which is said to attack fiercely in a strait line, I should relate to this today.

I think three types of people are very important here to get KEK going. The first type is young people for obvious reason. The second is people from outside. This is important to keep the organization from rusting. We welcome new point of views. The third is people who push themselves hard into the direction to achieve a goal. Needless to say, that the last type is the Boar type. To get the J-PARC project really going, we need the third type more than ever. I would say that I belong to the third type myself.

After I became the DG of KEK, I am pleasantly surprised to find out that KEK is very highly regarded internationally. Since I had been in non-accelerator field for neutrino researches, I was not fully aware of this. When I visited India, France, Germany, China, Russia and so forth, I was getting many requests for collaboration with KEK. In India, for example, the Head of DAE was very much interested in getting more collaboration with KEK. The President of India was originally a researcher on rockets and he has been eager to get young generations into scientific fields.

In the mean time, I have walked through KEK to find out KEK employees' view. I have been to 50 groups to exchange ideas. Then I did receive many complaints, more than I anticipated. I think KEK have been getting through too much in too short a time, there are many conflicts we need to rectify. The first thing I am planning to do is to review the management structure and make it a better system. The second is to link between different fields of research. This would promote wider view on the way we carry out our researches. I would promote people to wear more than one hat. The third is to bring out excellent successors for the future. I will announce people of outstanding work at the beginning of each year.

KEK is in a transition period for the next few years in both research activities and in management. The J-PARC (Japan Proton Accelerator Research Complex) project at Tokai Campus will be completing construction of its accelerators and is heading for the first experiment period.

The J-PARC will be the place for researches on particles, nuclei, material science, life science and so forth. Electron-positron colliding-beam accelerator (KEKB) in Tsukuba Campus has been fully utilized taking an advantage of world highest beam intensity for this type. We expect more results on the difference between particle and its anti-particle. In the same time, we start various R&D efforts for future research projects, such as International Linear Collider project (ILC) and the next synchrotron radiation project, Energy Recovery Linac (ERL), to stay on a leading role in world-wide researches.

Two years past since the reform of KEK into an Inter-University Research Institute Corporation. We are given 6 years to adjust ourselves to the new status as an independent corporation, after which period, we need to show how well we have worked it out. I consider the first two years to be an introductory years to learn and digest the reality of it. The second two years should be the time to get the real actions going, the last two years to be the time to further develop what we learnt from the 2nd period. We are entering the 2nd period where we will review operation and management scheme, enhancing good parts and modifying inadequate parts, taking advantage of our new status being less restricted by the governmental regulations. These improvements will enhance research activities in a long run.

I shall do my best to get as much outside support as possible as the facility for researchers from all over the world. I ask all the KEK employees to work hard together to get KEK going. I shall also welcome good suggestions from anyone.

Director General , Atsuto Suzuki

editor's note

Former Director General Professor Yoji Totsuka stepped down due to his health problem last March and Professor Atsuto Suzuki became the Director General on April 1, 2006. He was the Vice President of Tohoku University. He has been a leading figure in neutrino physics and has received many prizes for his outstanding works.

The J-PARC linac has successfully accelerated the beam to the design value of 181 MeV

The J-PARC linac accelerated negative hydrogen beam up to 181 MeV on January 24th. The beam energy was measured by means of time-of-flight. The peak current, the beam pulse length, and the repetition rate were 5 mA, 20 μ sec and 2.5 Hz, respectively. These values were selected for the purpose of the initial beam study, to avoid a possible damage to accelerator components, if something would go wrong at high beam power. During the beam commissioning, both RF power source and cavity system were very stable. This stability together with a very accurate alignment of all the magnets, especially in the drift-tube linac, were the two major elements to allow the rapid tuning of the linac. The acceleration to the full energy was achieved three months earlier than scheduled.

“J-PARC” is an acronym of the Japan Proton Accelerator Research Complex under construction at Tokai, Japan, which is approximately 110 km north of Tokyo. This is a joint project between the High Energy Accelerator Research Organization (KEK) and the Japan Atomic Energy Agency (JAEA). The accelerator system comprises a 400-MeV proton linac (181 MeV at the first stage of Phase I), a 3-GeV, 25-Hz Rapid-Cycling Synchrotron (RCS), and a 50-GeV Main Ring Synchrotron. The RCS provides the Materials and Life Science Experimental Facility (MLF) with the 1-MW beam to generate the pulsed muons and the pulsed spallation neutrons. Every three seconds, the RCS beam is injected to the MR four times. Then, the beam is ramped up to 50 GeV (40 GeV at Phase I) to be fast-extracted for the neutrino production or to be slowly extracted to the Hadron Experimental Facility (HDF). The neutrinos thus produced are sent to the SUPER KAMIOKANDE detector located 295-km west, while the slowly extracted beam will be used to produce secondary beams for the hyper-nuclei experiments, the Kaon rare decay experiments, hadron spectroscopy experiments and so forth, or to perform primary beam experiments in the HDF. The J-PARC construction started in April, 2001. The beam was accelerated by the Radio-Frequency Quadrupole (RFQ) linac up to 3 MeV on November 20th, 2006 which was just the same day as the beam commissioning started. Then, it was accelerated by the first tank of the Drift-Tube Linac (DTL) up to 20 MeV on December 19th, 2006 and by the second and third tanks of the DTL up to 50 MeV next day. All the thirty separated-type DTL (SDTL) cavities driven by fifteen klystrons were ready for the acceleration up to 181 MeV at midnight on January 19th. Afterwards, a phase scan for each pair of the SDTL cavities driven by one klystron was tried and, finally, the scan through fifteen pairs was completed on January 24th. In each scan the beam energy was measured by the time-of-flight method.

The J-PARC DTL has quadruple electromagnets, which are variable focusing elements, while driven by klystrons. In order to meet these conflicting requirements, the RF acceleration frequency was chosen as 324 MHz rather than widely used 350 MHz, the compact quadrupole electromagnets were developed by fully utilizing the electroforming and wire-cutting techniques,

and the 324-MHz klystrons with a pulsed power of 3 MW (500 μ sec and 50 Hz) were first developed by a manufacturer in close collaboration with the J-PARC linac team. The combination of 3-MeV RFQ linac and the 324-MHz RF source began to be considered as the best choice of the front end of proton linac by many future projects of FNAL, ISIS, GSI FAIR and CSNS, partly because the 324 (or 325) MHz, 3 MW pulsed klystrons are available now, and partly because the frequency of 324 (or 325) MHz is one quarter of L-band frequency, which will be used for the superconducting International Linear Collider.

The RCS beam commissioning will start this fall, while the beam commissioning of the MR and the muon and neutron production in the MLF will start in May, 2008. By the end of 2008, the beams will be provided for the J-PARC users. The earlier-than-scheduled success of the linac beam commissioning should be very encouraging for the users-to-be.



The author Professor **Yoshishige Yamazaki** is the Leader of the Accelerator Division at the J-PARC Center. He also serves as a Deputy Director of the J-PARC Center.

Science at J-PARC

A unique feature of J-PARC is that it is a multi-purpose facility to promote research on wide range of field utilizing single proton accelerator complex. How can we do it at J-PARC ? Usually an accelerator facility, in a large scale and expensive, is constructed for one major purpose. For example, a high-energy accelerator is constructed for particle physics to look for new particles not yet discovered, an electron (or positron) storage ring for intense X-rays, and a heavy-ion accelerator for medical applications. At the J-PARC accelerator complex, high intensity proton beams will be available in three different beam energies from three proton accelerators at the same time: a proton beam at 600 MeV (Million electron Volt) through a superconducting proton linac, a proton beam at 3 GeV (Giga electron Volt) with the beam current of $333 \mu\text{A}$ from the 3-GeV proton synchrotron, and a proton beam at 50 GeV from the 50-GeV proton synchrotron. Three proton beams are used for three different research fields: the 600 MeV proton beam for R&D studies toward accelerator-driven nuclear transmutation, the 3 GeV proton beam for materials and life science, and the 50 GeV proton beam for nuclear and particle physics.

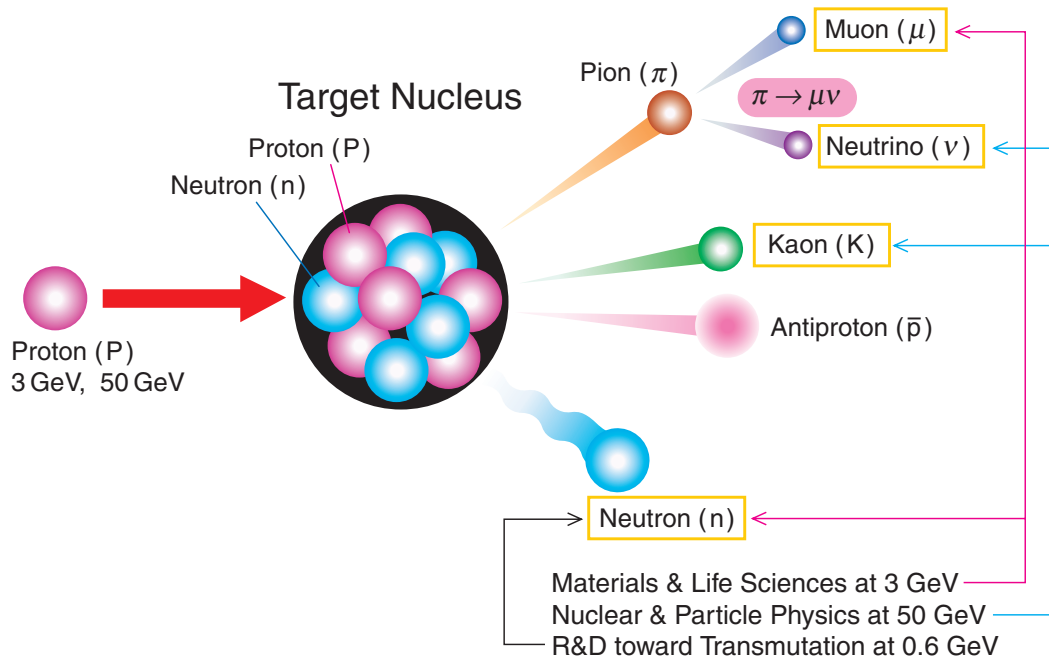
The reason why we use three different proton beams for three different purposes is that the proton beams are utilized to produce various secondary beams for different purposes. The proton beam at 600 MeV produces abundant spallation neutrons, the one at 3 GeV produces pulsed neutron and muon beams, and the one at 50 GeV produces various meson beams including kaons and neutrino beam.

Neutron is a particle with almost the same mass as a proton (hydrogen nucleus) and at very low energy behaves as a wave like X-ray. They can probe the structure of various materials in atomic scales. They are more sensitive to light atoms, hydrogen atoms in particular, in a molecule compared with X-rays, and also a good probe for magnetic structures. Various applications to protein analysis, structural analyses for soft matter (liquid crystals, etc.) and high-temperature superconducting materials will be conducted at J-PARC.

An ordinary nucleus is composed of two kinds of quarks, "up" and "down" quarks, only. Kaon, which has a "strange" quark inside, is useful to implant "strange" quarks into a nucleus. Such exotic nucleus is called a hypernucleus. Study of hypernuclear properties would give us new insights on new kinds of nuclear force binding these quarks into a hypernucleus. The high intensity kaon beam at J-PARC will enable us to produce new types of hypernuclei abundantly.

There are three kinds of neutrino: electron neutrino, muon neutrino, and tau neutrino. They had been believed to be massless in the Standard Model of particle physics until neutrino oscillation phenomena were discovered recently. With very tiny masses, three neutrinos could be mixed each other. The origin of the neutrino mass is one of the great mysteries in particle physics. The details of the mixing of neutrinos will be investigated in high precision and in high sensitivity with high intensity neutrino beams at J-PARC.

We hope research at J-PARC will further evolve and be synthesized with each other to form new research areas in a future.



The author of this article, Professor **Tomofumi Nagae** has been taking a leading role in the J-PARC Project Office.

Greetings from Tokai-mura



Hello. My name is Tatsuya Murakami, the Mayor of Tokai-mura where J-PARC construction is going on for the 2008 start of the J-PARC operation. All of us are looking forward to meeting scientists from all over the world. So, this is a welcome message from us, the Tokai-mura residents.

Tokai-mura is the place where the first nuclear power research organization (present JAEA: Japan Atomic Energy Agency) was founded in Japan, so that some of you may know a bit about us.

Tokai-mura is located 110km north (about an hour ride/drive) of Tokyo, or 70km north east (about an hour drive) of Tsukuba. It is the north end of Kanto plain, from which we can see mountains on the north side, Pacific Ocean on the east side where international seaport, Hitachi-Naka is located. Tokia-mura is a small village (37 km² area) and quite flat (max. 10m from sea level). We have 50 years of history as the town for nuclear power research. We are only 16 km away from Mito, the capital of Ibaraki Prefecture, and are right next to the industrial city, Hitachi, so that population increase is quite steady. Present population of Tokai-mura is 36,000.

In the past, we had many nuclear-research-related visitors from overseas. However they stayed inside of their research facility and did not have much interaction with us. After we learnt about J-PARC, we decided that we should become an international village keeping positive productive interactions with the researchers from all over the world. We organized a committee to establish a plan to achieve this. The committee consisted of women with experience of living outside of Japan. We asked Dr. Arai and Dr. Ohsaka of KEK to be the advisers for the committee. We plan to become an international city of science, research and culture, like Tsukuba where non-Japanese researchers and their family members feel easy and relaxed. A volunteer organization, Tokai-mura International Association group has been actively working to support non-Japanese visitors on daily life matters. It has been hosting events to promote establishing good relationships between village residents and non-Japanese visitors. Ibaraki Prefecture Government recognizes Tsukuba and Tokai as the "Special Research District" where special legal considerations are applied for non-Japanese people. Japan being an island country where everything has been done with a single language for thousands of years, Japanese hardly had a chance to learn how to live and work together with people from outside of Japan. However this does not mean we are uninterested in outside of Japan. Tokai-mura is an international research town and we are eager to learn from and associate with people from outside. We welcome your participation to make this village richer in terms of culture. We are looking forward to meeting you here.

A handwritten signature in black ink, which appears to read "T. Murakami". The signature is stylized and written in a cursive-like font.

Past and Present of Tokai-mura (Tokai Village)

Tokia-mura isn't just another small village in the middle of nowhere. As it is facing to the Pacific Ocean, people lived here for a very long time. During the ground preparation stage for the 50GeV Ring of J-PARC, a settlement connected to a large salt farm of medieval time (Muramatsu-Shirane ruin) was discovered.



While the excavation of the ruin had held up the J-PARC construction, KEK organized a three-day field study for elementary school students with the help from the board of education. Kids had a grand time learning about their ancestors. Beside for this, about 60 ruins (~2000 years old) have been discovered in Tokai area.

These ruins tell interesting life style of the time. You will find many places far away from the ocean but have a name (Aokiga-Ura, Masaki-Ura and Hoso-Ura) that indicates a bay. This tells that ancient shore line was much closer. There are shrines and temples at these "-Ura" places indicating that they were there to protect the village from outside intruders. Muramatsuyama-Kokuzo-Do

was constructed at 9th century, containing a Kokuzo statue believed to be curved by a famous leader of a Buddhism sect of the 11th century, Kobo-daishi, out of a drift wood.

Modern-day Tokai village was born in 1955 by amalgamating Muramatsu village and Ishigami village. The Japan Atomic Energy Research Institute (JAERI) founded their Tokai facility in 1957 which was the dawn of the nuclear power research of Japan. (JAERI became



JAEA (Japan Atomic Energy Agency) in 2005 combining Japan Nuclear Cycle Development Institute.) Since then, numerous research institutes and development facilities have been built in Tokai, as well as in adjacent towns. About 36,000 people are living in Tokai including some 300 non-Japanese researchers. Under the leadership of the Mayor of the village, Mr. Tatsuya Murakami, Tokai village is setting a firm step forward to become an international research center of Japan, taking the opportunity of the starting of the J-PARC. Ibaraki prefecture also started a five-year action plan for internationalization of the whole district.

The ruins and researches are not all. There are festivals such as Cherry Blossom Festival, Summer Festival with fireworks, Sweet-potato Festival, and so forth. "Hitachi Seaside Park" is near by which is a huge seaside park with an amusement park, cycling courses, flower gardens and so forth. One of the biggest Rock music festival, "Rock in Japan", is held at the park every summer and more than 100,000 people enjoys music.

Access to other places is not bad: it takes only 15 minutes from Tokai village to Mito city (the capital of Ibaraki prefecture) by train and 1.5 hours to Tokyo by express train. Between KEK (Tsukuba city) and JAEA (Tokai village), there is a commuter bus service with which it normally takes less than 1.5 hours.



The author Dr. **Toshiya Otomo** is a material scientist studying atomic structures of disordered materials with neutron scattering technique. He has been working at KEK neutron science facility since 1994. He is in the J-PARC project office of KEK working hard on J-PARC construction.

Welcome to our KEK Archives Office !

High Energy Accelerator Research Organization (KEK), since founded as National Laboratory for High Energy Physics in 1971, has been the center of particle physics in Japan with the 12GeV PS, Photon Factory, TRISTAN and KEK-B Factory and has produced many splendid results.

The reorganization of KEK in 1997 made former Institute for Nuclear Study (INS) of the University of Tokyo to join into the new KEK. As they had been the central research facility in nuclear science before former KEK was established, this made us able to access to their enormous amount of historically valuable documents in particle and nuclear physics.

The KEK Archives Office was created in 2004 under the former Director General Hirotaka Sugawara.

What are the “historical materials - archives” for us? We occasionally find quite valuable information either piled up or discarded. They often are very important for historians and physicist who will plan for future.



The past information could give a great insight for how to proceed. KEK archives office has been working hard to make these disregarded historical evidences into a usable form for all occasions. One of our activities includes uncovering the historical evidences of KEK which were not known before in a open way. This includes interviewing the people who played an active role in the past. We also convert drawings and pictures into a digital form so that they can be kept for a long time. This will be made into KEK Digital Archives open to

public. We are part of international effort to link archive records between organizations all over the world. We are fighting with mounds of files and data daily. We occasionally make exhibition on particular subject of science. One of this was an exhibition of the Nobel Laureate Shin-ichiro Tomonaga and the history of Kyodo Riyo Kenkyusho, which was a new form of carrying out research by having a national facility (such as KEK) as the central facility and all universities merge in. We are planning to establish a system for finding information through a worldwide network. We could surprise you.



The author of this article, *Dr. Michiko Sekimoto*, is the head of KEK Archives Office. She has been one of the key person in proton synchrotron related experiments.

Public Relations Office

KEK started open house event in April 1976, right after the delivery of the first beam from Proton Synchrotron accelerator. We probably were the first government laboratory in Tsukuba Science City to have such annual open house. For a long time, interfacing with general public had been taken care by a committee of researchers organized by KEK administration office, and no dedicated standing organizations were placed. It was October 2001 when KEK Prof. Hiroataka Sugawara, then KEK’s Director General, invited a famous Science Commentator, Mr. Yuichi Takayanagi of NHK (Japan Broadcasting Corporation) as the Professor to lead the newly established Public Relations Office. As Takayanagi set the course of public relations activity in KEK and retired in 2003, had completed his term in the office, Dr. Youhei Morita succeeded the office.



Youhei Morita has been the key person in communication on the Internet, as he initiated the KEK Homepage in 1992, and organized an effort to establish the web page called “Kid Scientists” in 1998. The Latter offers interesting readings on science for young kid and was motivated by the public concern that young generations were losing interests in science in general.

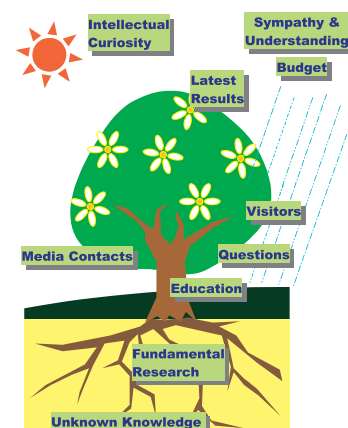
Since the start of this office, KEK’s out-reach activities became quite visible. This includes updating the news page on Web and briefing to news media every week, publishing various kinds of pamphlets, taking care of visitors of all kinds, orchestrate KEK

Open House and other science events in town, and various kinds of lectures for high school students and general publics, working together with science museums in Japan and so forth. Most of them have been carried out by a small number of people in the Public Relations Office. Hence the office is one of the busiest spots in KEK.

The basic concept of the office is shown in the figure below which Youhei uses to explain their activities. He considers that the major body of this public relations work is “education”. In today’s Japan, young generations tend to take the outcomes of science for granted and not recognize the importance of carrying out the continuous effort of fundamental research activities, which would have, in turn, renovated our lives.

As the result, their interest in science, especially in fundamental science and basic researches is fading rapidly. This is a serious threat for us, as we need motivated successors to continue our researches that would have a span of over 10 to 20 years. So the Public Relations Office is hard at work to laviate the spirits of children towards science. Besides for this, Youhei has been the Asia-region communicator for the International Linear Collider project. From the amount of work he has been doing, I wonder when he finds time to sleep and eat. (T.K.O.)

A Tree of “Scientific Communication”



Research Service Office

KEK Research Service Office evolved from former KEK International Collaboration Office (KICOFF).

KICOFF was established in 1997 to promote internationalizing KEK under the Director General Sugawara and headed by Tokio OHSKA. High energy physics laboratories are international by nature. However, the Japanese government does not recognize international anything, unless it is related to Ministry of Foreign Affairs. (There are some exceptions such as Japanese school for Japanese children living outside of Japan.) This concept stems from the geographical and historical condition Japan has been in, namely isolated from outside by ocean. This lead us into a conflict between carrying out our research activities as an international facility and the governmental view of what is to be done here. The KICOFF started bilingualize lots of things on site, including building names, emergency procedure, various announcements. We offer e-mail news in English, free weekly English class, Japanese Language Class for visitors, to name a few. However, mentality of the majority (but not all) of non-researchers in KEK is reflecting the governmental view and we soon hit a brick wall in many places. We could not produce as much improvement as we hoped for. When we realized that normal approach to this perennial problem would not work, we started to look at this from totally different direction. The first thing we have to achieve is to let the KEK employees to recognize that KEK is in fact an international facility. So we pleaded cafeteria and restaurant chefs to serve foreign dishes on regular bases, so that people eating lunch there would gradually get the hint that KEK might be an international place. This "International Dinner" project was nationally broadcast by NHK television as a unique attempt. Tokio organized a group called "Bread Tasters of Tsukuba" and have been doing bread-tasting party. This made Tsukuba bakeries to realize that they should consider the taste preference of non-Japanese as well. As a spin off of this, decent French baguettes are now available from KEK grocery store. KEK recognized the importance of English speaking capability of all employees and offered TOEIC (Test of English for International Communication) test last February for employees. This was a big step forward. (May be that the International Dinner Project was effective.) Now this office is getting into how to improve KEK for visiting Japanese researchers as well and the office name was changed to Research Service Office.

Internationalizing inside of KEK site is surely insufficient for non-Japanese families to live in Tsukuba so that Tokio started a group called Tsukuba International Network (TIN) for which many major national labs in Tsukuba have been participating. The first project of the TIN group was to persuade a bus company to display route numbers in addition to destination display written only in Japanese. This was realized some 5 years ago and now people who



cannot read Japanese could take a bus with some confidence. We have been appealing to hospitals, police, etc. for their doing their shares in taking care of non-Japanese in town. Tsukuba City office now provides important city announcements in other languages. Tokio has been appointed by the Mayor as a director of Tsukuba City International Affairs Committee. Expecting that we will get into more international collaborations soon (J-PARC, ILC), members of this office, Tokio OHSKA and Hiroko Shibasaki (picture left) will be kept quite busy. (T.K.O.)

Kabuki – Japanese Traditional Theatre alive

When asked about Japanese traditional theatrical art, I would say Kabuki is the most popular among the famous ones, Noh, Bunraku (Japanese puppet theatre), Kabuki and so on. They each have their special appeal. While Noh play is amazing because of keeping the 600-year-old original form and Bunraku is amazing for its sophisticated art of handling puppets, Kabuki has been putting very conscious efforts in appealing to the real-time audience. It is surprising that Kabuki has kept this style and survived through its 400-year history. There is a reason behind this.

Gifted great stage directors, for example Franco Zeffirelli and David McVicar, could produce great opera performances audiences would never forget. However, one rarely encounters such performance simply because there just aren't so many great stage directors around. On the contrary, Kabuki performances are almost always excellent although there is no stage director for it. Instead of waiting for a genius director of a century to show up, Kabuki relies on the inheritance of the art from centuries of creative experiences by great Kabuki actors and musicians of the past. It is like the case of a vintage wine. What the audiences see at any second on stage is the crystallization of the art by Kabuki families over 400 years. Because of this, most people on stage perform just like having a genius director beside them. This is one of the wisdom Japanese has established long time ago.



One of the great Kabuki Actors is Mr. Tanosuke SAWAMURA (born August 4, 1932) who started his career at his age of 9. So, at his age 74 now, he now has 65 years of professional experience. He went through difficult times, especially through the time of the WW II, but he turns the experiences into his insights on humanity. His acts show the great depth of his understanding of the role. He is a real professional actor of high caliber.

Feudal government of Edo era (1603-1867) prohibited female actresses to be on stage, as part of their ethics control. Hence, Kabuki is played by male actors only, even for the role of a female. When Tanosuke plays a role of a female, he appears to be more feminine than a real female.

This is not an easy task, as men are physically different from women and body would not respond to what you want. Kabuki actors have accumulated the know-hows on these problems. Of course it

will take years of hard practice for Kabuki actors to integrate the know-hows in him so that he can represent the 400 years of history.

Tanosuke and other Kabuki actors teach the art to the successors everyday. They will also contribute their own inventions to the know-how accumulation, so that the know-how will be better than that of past and good actors continuously emerge to keep the art alive. Watching Tanosuke's acting, one realizes that Kabuki is an art of how to express internal mental condition by subtle sophisticated movements. It is not just the vocal and facial expressions. From the perfectly tuned acting, the thought and emotions flow out and move the audience. Kabuki actors are outstanding psychologists as well as directors of their own. When Tanosuke plays male role, he will be a real very attractive man. How could he be a perfect woman some time and a perfect man some other time. For his great achievements, Japanese government gave him a "Human National Treasure" status, which is the highest honor in cultural field.

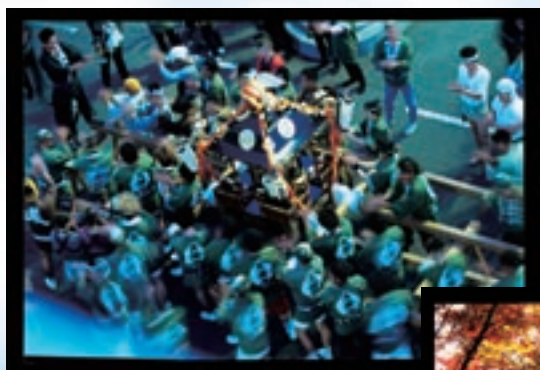
I should also mention about the musicians. Kabuki should not be considered as a play. Music part of Kabuki is also very important and is an art itself. Mind captivating recitativo by a singer off stage accompanied by Shamisen strings and percussions is extremely effective and is perfectly synchronized with the actor on stage, which in turn appeals to the audience far more than without it. This perfect harmony between the acting and the music is also a result of the 400 years of history. Well, I will never be able to describe all of these. You should go see it. (T.K.O.)



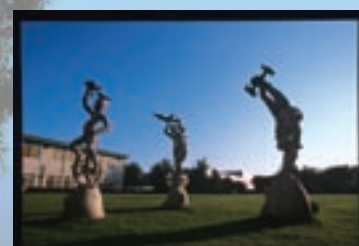
Tanosuke as "Onaka" (wife of Tatsugoro), Bando Kametoshi as the child in "Kamino-megumi wagoh-no-torikumi"

Photo credits:

Front cover picture was taken at the Tokai-mura when people gathered for a little festival. You see the Mayer, Murakami and Tokai-mura residents, including several J-PARC members.
Back cover picture shows sceneries of Tokai-mura.



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