Interview

A conversation with Dr Anthony Cox, Counsellor, Science and Technology, British Embassy, Tokyo, about Festival “UK98”.

The first recorded exchange between Japan and the United Kingdom (uk) can be traced back to 29th April 1600 in the Ieyasu Tokogawa era, when an Englishman named William Adams managed to reach land in Sashiu, Kyushu, after the Dutch ship he was on hit stormy seas and he was shipwrecked. He later became one of the first foreigners ever to be given Japanese citizenship and changed his name to Mr Anjin Miura. There is now even an annual fireworks festival held in Ito city, Izu Peninsula, bearing his name and today, links between the uk and Japan are stronger than ever. Indeed, Britain welcomes more than 700,000 Japanese visitors each year and has 60,000 Japanese residents. Furthermore, British education, science and technology played a major role in the early development of industry in Japan. For example, British engineers were involved in the building of the first lighthouses and the development of Japan’s railways, coal mining and shipbuilding industries, and guided the establishment of modern water supply and sewerage systems in parts of Yokohama. In terms of education, a Scot named Henry Dyer was a central figure in establishing the forerunner of Tokyo University’s Faculty of Engineering.

In this “Year of The Tiger” the United Kingdom has launched Festival “uk98” and we have asked Dr Anthony Cox, to talk to us about the aims, organisation and technological highlights of the festival.

OBI: First of all, can you describe the role of the Science and Technology Section at the British Embassy?

Dr Cox: A difficult question! Essentially our role is to promote scientific and technological relations between the uk and Japan; that includes industrial, academic and government relations.

OBI: ok, now let’s move on to Festival “uk98”. Can you tell us about its objectives and how it was planned and organised?

Dr Cox: It will run for 12 months and consists of more than 200 individual activities such as fashion shows, cake making, bell ringing, scientific conferences, rugby and cricket games and so on. One wish is to remind Japan about contemporary, youthful and dynamic Britain, while also reflecting on the historical links in science, technology and culture that the present relationship has depended upon.

OBI: Is there a particular reason for having the Festival in 1998?

Dr Cox at the British Embassy, Tokyo

Dr Cox: The genealogy goes back about 4 years, but it is really a combination of factors which makes ’98 such a good year to highlight the role of Britain in the world. For example, the Emperor will be going to Britain this year, the uk holds the Presidency of the European Union. And of course, 1997 was busy, what with the handing over of Hong Kong to China.

OBI: Can you tell us abut the organisational aspects of the Festival?

Dr Cox: First of all this is a joint effort between the British Council and the British Embassy. Within the Embassy the Ambassador presides over the whole event, but the Minister, Charles Humphrey, is in charge of the project. We established a Festival office and recruited three people to manage the general organisation. The cultural, commercial and scientific aspects were divided between the Council and I, together with Dr Brendan Barker of the British Council, am in charge of organising the science and technology events throughout the year. In terms of financing, the British Government made a small contribution to the costs of administration. I have to say that the Yomiuri Shimbun is underwriting many of the events, particularly the Science Museum and Tate Gallery exhibitions, which are very expensive to organise.

OBI: For you personally, what are the highlights of the Festival?

Dr Cox: The Science Museum exhibition is something to look forward to, but the thing that really tickles the imagination is bringing over Stephenson’s Rocket. It epitomizes the Industrial Revolution and will be exhibited in Tokyo, Kobe and Kita-Kyushu. This will be a part of a display of 60 or 70 major artefacts of the Industrial Revolution, plus a sprinkling of contemporary ones like “Concorde” and dna. The “Rocket” should be very exciting. Children can actually touch it and it will come alive out of their history books. Another exhibition that I am particularly looking forward to is the Science for Life’ exhibition in July. This will show the sciences that affect our bodies, organs and cellular structure. It’s a very ’hands-on’ exhibition that the Wellcome Trust Centre in London have made available to us. It will be sponsored by the University of Tokyo in conjunction with Monbusho, and there will be free admission. You have the opportunity to walk through a model of a human cell and see the electrical impulses running down the walls and so on. It should be a fascinating experience. I have described events that look backwards to the Industrial Revolution, but you also have to ask what we are doing about the present and the future. We will have exhibitions by British Aerospace and British Telecom and, in the Autumn, we will have a chance to see ’Thrust’, the car that broke the world land speed record only a few months ago. We will also have quite a number of speakers coming to Japan throughout the year. Dr Ian Wilmut, from the Roslin Institute, the inventor of Dolly the sheep will come in July, and for the younger generation there will be this year’s Royal Institution Christmas Lecturer The “Christmas Lectures” were first initiated by Michael Faraday in 1826 with the aim of communicating science in a manner that would capture the hearts and minds of the young.

Organising all these activities has occupied 60 to 70 percent of my time and it’s good to see them finally come to fruition. We have had tremendous support from Japanese industry for which we will always be indebted.

OBI: What impression would you like to leave at the end of the Festival?

Dr Cox: We would like people to realise that Britain is not just Beefeaters and tweeds. We would like people to have a vision of contemporary Britain and its successes, its creativity and its global contributions to a wide variety of areas. Britain is an ideal partner for cooperation and investment.

Interviewed by Adarsh Sandhu

Further information on Festival “UK98”

- `http://www.uk98.or.jp`
- British Embassy · 1 Ichibancho Chiyoda-ku · Tokyo 102-0082 · tel 03 5211 1313 · fax 03 3230 0624
- British Council · 1-2 Kagurazaka · Shinjuku-ku · Tokyo 162-0825 · tel 03 3235 8031 · fax 03 3235 8040

A Historical Look at Technology and Society in Japan (1500-1900)

This is a three-part essay based on a keynote lecture by Dr Eiichi Maruyama at the Japan-Sweden Science Club (jssc) annual meeting, Tokyo, 31 October, 1997. jssc is a society for Swedish scientists in Japan and Japanese researchers who have stayed in Sweden. It is open to anyone interested in all aspects of science in these countries. See `http://www02.u-page.so-net.or.jp/fa2/crane/` for details.

Dr Maruyama studied science history, scientific philosophy, and physics at the Tokyo University. After graduating from the university in 1959, he joined Hitachi, Ltd., and became the director of the company’s advanced research laboratory in 1985. He is currently executive director of the Angstrom Technology Partnership.

Introduction

Japanese industry today produces many technically advanced products of high quality. There may be a tendency to think that Japan has only recently set foot on the technological stage, but there are numerous records of highly innovative ideas as far back as the 16th century that have helped to lay the foundations for the technological prowess of modern day Japan. The aim of this series of essays is to shed light on some historical aspects of the technological development of Japan that might otherwise be overlooked, and in certain cases are not even well documented.

The table on the next page lists important historical periods in Japan from ad 250 to the present day, and will serve as a useful reference to this series of essays.

The first essay discusses some early examples of Japanese biotechnology and microlithography; the second essay relates to the organisation and management of people and the development of a highly sophisticated socio-technological infrastructure; the third and final essay concerns changes in education and scientific thought following the *Meiji Restoration* in 1868.

Gunpowder and Biotechnology – Ukiyo-e and Microlithography

In many parts of the world, and Japan was no exception, the 16th Century was a time of conflict and violence. In Japan, a number of feudal lords were embroiled in fierce battles for survival. The battles produced three victors who attempted, one after another, to unify Japan. The last of these was *Iyeyasu Tokugawa*, who founded a “permanent” government which lasted for two and a half centuries before it was overthrown and replaced by the Meiji Government in

1868.

One particularly well documented battle was the *Battle of Nagashino* in 1575. This was a showdown between the organized gunmen of the Oda-Tokugawa Allies (two of the three unifiers) and the intrepid cavalry of *Takeda*, who was the most formidable barrier to unification under *Nobunaga*. Three groups of untrained infantry men with 3 000 match-lock guns completely defeated the troops of veteran horsemen by cyclical firing of their weapons. Historians regard this tactic as being Nobunaga's invention, occurring as it did about 30 years prior to its introduction on an European battle ground. The events leading to the victory date back to 1543 when a Portuguese ship was wrecked off a small island off to the south-west of Kyushu called *Tanegashima*. The ship bore a pair of match-lock guns. The Lord of Tanegashima, a 15-year old youth named *Tokitaka*. Tanegashima, cleverly recognized the benefit of possessing firearms and purchased the guns at a price of 2 000 *ryo* (equivalent to $1 000 000 at today's prices). He then ordered his retainers to copy the design and manufacture duplicates. Historical archives show that when the Portuguese returned to Tanega-shima two years later, they were very surprised to find guns being manufactured there.

Gunpowder

Another factor that contributed to the growth of the gun industry in Japan was the supply of gunpowder. Black gunpowder is made from charcoal, sulphur and potassium nitrate, known also as nitre. While charcoal and sulphur were abundantly available, nitre, which is readily soluble in water, did not exist naturally in Japan and had, consequently, always been imported from China. However, by using an early form of biotechnology Japan managed to secure a stable supply of nitre from its own resources. The process used for making the nitre was as follows. A rain-proof hut was built with a one metre square fireplace in the centre around which several one metre deep holes were dug. Stacked layers of mugwort leaves, silkworms' excreta and chicken droppings were thrown alternately into the holes. The holes were then covered with earth and warmed by the heat from the fireplace.

Subsequently, human urine (a good source of nitrogen!) was added and the material in the holes was left for four to five years. During this time the various materials underwent a series of chemical reactions: the nitrogen compounds (urea and uric acid) in the excreta decomposed into ammonia, this was then converted by bacteria into nitric acid which reacted in turn with potassium in the mugwort leaves to form the potassium nitrate or nitre. Subsequently, the contents of the holes were dug out and put into a barrel with a perforated bottom. Water was then poured in from the top to leach or dissolve out the nitre. The resulting solution was then refined and dried to make a pure product.

Period	Dates
Yamato	250–710
Nara	710–794
Heian	794–1192
Kamakura	1192–1333
Muromachi	1333–1573
Momoyama	1573–1603
Edo	1603–1867
Meiji	1867–1912
Taisho	1912–1926
Showa	1926–1989
Heisei	1989–

Ukiyo-e and Imaging Technology

The introduction of *Ukiyo-e* to Paris in 1850 created enormous enthusiasm for this form of Japanese art. Its fresh and simple use of colour together with its bold and clear designs was highly appreciated. Indeed, many impressionist and post-impressionist artists such as *Monet*, *van Gogh* and *Degas* were so deeply affected by Ukiyo-e art that they used its concepts in

their own works. Ukiyo-e is a multi-coloured wooden block print which can be thought of as a high-precision colour printing technology. A painter creates an original picture design and a team of wood cutters engrave that picture into a number of wooden blocks, one for each of the different colours. Finally, a print is made using the seven or eight wooden blocks in accurate registration. Extreme care is required to prevent misalignment. A deluxe version of this technique called *Nishiki-e* also exists in which each print is made with 50 or 60 blocks, using a powder of gold and silver foil as well as the ordinary dyes on embossed paper. These prints are treasured by connoisseurs worldwide.

Techniques analogous to those of Ukiyo-e are used in the microlithography industry in Japan today. For example, the fabrication of microelectronic circuits such as the 256-megabit DRAM, where 10 to 15 separate exposures are required, employs multiple masks that have to be aligned with submicron accuracy.

Scientific Japanese

近年、超伝導現象に基づく放射線センサー機能を有する極低温検出器に関する研究が活発になされ、その検出器性能の最適化が行われている。本稿は、超伝導によるトンネル接合検出器及び熱量計型検出器（ボロメーター、カロリーメーター）のに2種類の検出器の動作について解説する。現在では多くの優れた極低温デバイスの動作が実証され、極低温検出器の研究の動向が明らかになってきた。このことから、検出器の単なる最適化研究から実用的な応用研究へと推移したことがわかる。極低温検出器は X 線蛍光分析、可視光検出、高分子の質量分析等にも使用されようとしている。しかし、極低温検出器の性能の理論的上限値を得るには、さらなる研究開発が必要である。

In recent years, research and optimisation of cryodetectors, based on the use of superconductors to detect radiation, have been actively pursued. This review discusses the operating principles of two types of detectors: those based on superconducting tunnel junctions and those based on thermal effects, such as bolometers and calorimeters. The operation of many successful, low temperature devices has been demonstrated, and the direction of cryodetector research has become clearer, showing a shift in emphasis towards practical applications from pure detector optimisation. Cryodetectors are beginning to be used in such fields as x-ray fluorescence analysis, optical photon detection, and the mass analysis of macromolecules. However, for the performance of cryodetectors to approach their theoretical limits further work in research and development is necessary.

超伝導	chōdendō	superconductivity
現象	genshō	phenomenon
放射線	hōshasen	radiation
極低温	gokutei-on	cryogenic temperature
検出	kenshutsu	to detect
検出器	kenshutsu-ki	detector
性能	seinō	performance
トンネル接合	tonneru-setsugō	tunnel junction
熱量計	netsuryō-kei	calorimeter
ボロメーター	borometā	bolometer
カロリーメーター	karorīmetā	calorimeter
動作	dōsa	operation
X 線蛍光	ekusu-sen-keikō	X-ray fluorescence
分析	bunseki	analysis
可視光	kashikō	visible radiation
高分子	kōbunshi	macromolecule
質量	shitsuryō	mass
理論的	riron-teki	theoretical
上限値	jyōgen-chi	upper limit value

Correspondence
Japan Society of Applied Physics
Oyo-Buturi International
Kudankita Building 5f
1-12-3 Kudankita, Chiyoda-Ku, Tokyo 102-0073, Japan
Phone +81 3 3238 1045, Fax +81 3 3221 6245
E-mail jsapedit@mb.infoweb.ne.jp
http://wwwsoc.nacsis.ac.jp/jsap