

Radiology in Taiwan

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Taiwan is a small island that has always been influential in modern East Asia history. The history of radiology in Taiwan dates back to 1951, when, after a series of conflicts, the Radiology Society in Taiwan, now the Radiology Society of the Republic of China, was established. The ensuing 50 years have seen the burgeoning use of radiology and the training of many radiologists in Taiwan.

In 1895, Wilhelm Conrad Roentgen reported the discovery of the x-ray [1] and the Qing Dynasty of China was defeated by Japan in the First Sino-Japanese War [2]. According to the Treaty of Shimonoseki, Taiwan [3] was ceded to Japan in perpetuity [4]. There followed the importation of diagnostic and therapeutic x-ray machines to Imperial Japan to assist medical practice. An example of a machine of that vintage is shown in Figure 1. In 1945, after Japan's defeat in the Second Sino-Japanese War (1937–1945) and World War II, Taiwan was taken over by the Republic of China (ROC) administration. Four years later, the ROC government retreated from Mainland China and moved its capital from Nanjing to Taipei, Taiwan's largest city.

At that time, several physicians established radiology services with the assistance of the governments of the ROC and the United States [5]. On the basis of the Agreement of Sino-American Cooperation in Science and Technology (1949–1958), early Taiwanese radiology also benefited from the American side. Some ancillary radiology facilities were donated to Taiwan by the United States (Fig. 2). The early radiologists from 1949 to 1960 established diagnostic services mainly in military hospitals: National Taiwan University Hospital, Veterans General Hospital (currently the Taipei Veterans General Hospital), and the National Defense Medical Center.

In 1951, Jane Ching Wu established the Radiological Society of the Republic of China

(RSROC) in Taiwan [6]. With the assistance of Paul C. Hodges of the University of Chicago and the many radiologists who returned to Taiwan from the United States in the aftermath of World War II, radiology as a specialty gradually matured in the country [7]. In 1987, the Society of Nuclear Medicine in Taiwan was established, followed in 1993 by the formation of the Taiwan Society for Therapeutic Radiology and Oncology. Since its inception, the RSROC has evolved into a society focusing on diagnostic and interventional radiology. To avoid confusion with the existing Chinese Society of Radiology [8] in the People's Republic of China (PROC), the council of the RSROC is considering renaming the society the Taiwan Society of Radiology.

The official journal of the RSROC is the *Chinese Journal of Radiology*, which commenced publication in March 1976 as a quarterly journal. The English-language journal's mandate is the publication of original research, workshop proceedings, technical notes, and case reports of the society's members. The *Chinese Journal of Radiology* is currently cited by EMBASE/Excerpta Medica.

The current Taiwan medical education system is a modification of the American system [9]. After senior high school, students undertake a 7-year medical university training period that includes a 1-year rotating internship. Students who choose radiology as their career then undertake a 4-year radiology resident training program that includes a 6-month period of general medicine training. After passing the radiology board examination administered by the Department of Health, they are qualified as radiologists.

Currently, most subspecialties work as subcommittees under the RSROC umbrella. Every year in March, the 733 radiologists (as of December 31, 2007), more than 130 trainees, and about 200 technical exhibitors attend the society's annual meeting, which

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rotates between the major cities in Taiwan. Attendance at the 2007 meeting was 1,050. There were 120 oral presentations, 115 scientific exhibits, and 36 technical exhibits. Experts in subspecialties delivered 40 lectures in 12 categories, and 11 foreign speakers were invited to give lectures in plenary and subspecialty sessions.

In the early years when radiology training in Taiwan was in its infancy, many radiologists sought resident training in the United States. Many choose to remain in the United States where their achievements have been notable; examples include Chien-Tai Lu (University of Chicago and University of Iowa Hospital), Y. P. Huang and Hsu-Chong Yeh (Mount Sinai Medical Center), Ay-Ming Wang (William Beaumont Hospital), Fong Y. Tsai (University of California, Irvine Medical Center), Lee C. Chiu (Iowa University Hospital and Saint Joseph Medical Center), and Vincent P. Chuang (M. D. Anderson Cancer Center).

Others returned to Taiwan to pioneer the emergence of diagnostic and interventional radiology in the country. The list includes Lan-Chang Chiang and Chun Hsu (trained at

the University of Pennsylvania), Virginia Y. C. Kuan (trained at Bellevue Hospital), Chun Yu and Chien-Fang Yang (trained at the University of Chicago), Tsun Chang (trained at Louvain University, Belgium), Tong-Chieh Yang (trained at Columbia University), Chien-Yao Hsu (trained at Baylor University College of Medicine), and Chang-Yi Yu (trained at Rochester University). In addition, Paul Hodges, who first visited Shanghai, China, in 1915, also assisted in the establishment of the department of radiology of Veterans General Hospital in Taipei in the early 1960s [10, 11].

With the maturation of the radiology training system in Taiwan and increased global collaboration, the radiology expertise of Taiwan now rivals that of any country. In recent years, residents and fellows have tended to complete their training in Taiwan rather than elsewhere. The robust quality of this training is reflected by the increasing contribution of Taiwan radiologists to leading radiology journals [12, 13].

After the National Health Insurance program started in Taiwan in 1995, almost all radiologic examinations were reimbursed by

the single health insurance company, the Bureau of National Health Insurance, which is run by the Taiwan government. Only some new high-end examinations, such as cardiac MDCT for coronary arterial disease, whole-body MRI for health screening examinations, and PET/CT are not covered and are billed directly to the patient [14, 15]. The limited geographic area and dense population of Taiwan [16] mean that services such as CT and MRI are readily available to a substantial portion of the population.

Today, Taiwan boasts many research groups of international caliber such as the Laboratory of Integrated Brain Research at Taipei Veterans General Hospital [17], the MR Research Group at National Taiwan University and Tri-Service General Hospital [18], the MRI Laboratory at National Taiwan University Hospital [19], and the MDCT team at Taichung Veterans General Hospital. The latter group pioneered the use of ultra-low-dose MDCT in neonatal congenital heart disease [20, 21]. Also of note, the first MRI health examination center in the world was established in Taiwan [14, 15].

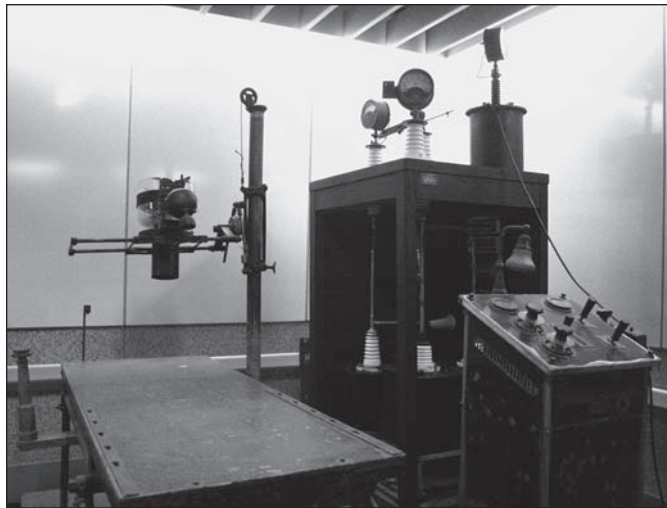


Fig. 1—Vintage x-ray machine used in Taiwan after World War II. Machine is example of x-ray equipment imported to Taiwan in Imperial Japan era. It is no longer operational and is on display at National Taiwan University Hospital. Design is similar to first x-ray machine designed by Wilhelm Conrad Roentgen, with power generator to produce high-voltage electricity. Machine was manufactured by Shimadzu Corporation, which remains active in biomedical equipment market. X-ray machine was used for several generations of patients during Imperial Japan, Kuomintang martial law, and modern democratic eras. Even during turbulent and changing times, medical science remained important and politically impartial. (Photograph courtesy of Tsai IT)

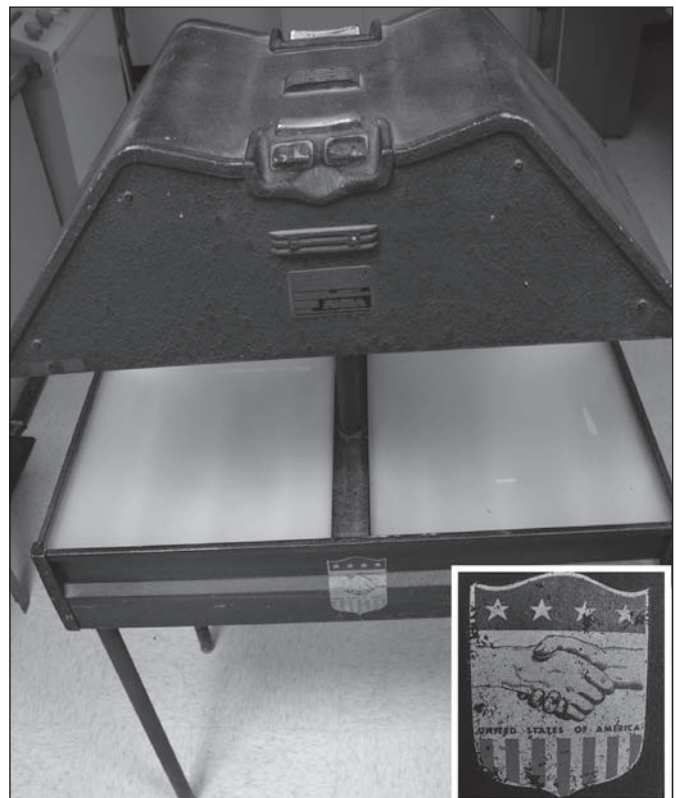


Fig. 2—X-ray stereoscope (Fred W. Borden, designer and manufacturer, San Jose, CA) presented to Taiwan from United States. This instrument was used from late 1960s to late 1970s. Inset shows label indicating Sino-American cooperation. (Photograph courtesy of Chou YH)

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The development of radiology in Taiwan reflects both the complex history of East Asia and the globalization of the world [2–4]. For an island country whose geographic area ranks only 139 among all countries on the globe [16], radiology-related publications have become prodigious, ranking 10th among submissions by country to the *American Journal of Roentgenology*. Within 50 years, radiology in Taiwan has risen from the ashes of postwar devastation to world-class status—a remarkable legacy of a small group of Asian radiologists who strived to serve their people and who aspired to excellence.

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