

THE FIRST FEMALE CHEMIST (AND PHARMACIST?) IN JAPAN: CHIKA

KURODA

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ABSTRACT

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This paper follows a line of research started some time ago by the author with the purpose of presenting to society the biographies of women who managed to overcome the prejudices and laws in force of the time in which they lived, which prevented them from carrying out university studies, to difference from what happened at the same time with men. The main objective is to show the biography of Chika Kuroda, the first woman to obtain a degree in Chemistry in Japan, in the first decades of the last century and also the second woman to obtain a PhD in Science in 1929 (some sources point out that she was also pharmacist, although this fact is not properly documented). The methodology used has been the search of data on this woman in bibliographical and computer sources, as well as in historic archives. As a main results, a biography of her, as complete as possible, has been constructed. Some brief biographical data on her compatriot Kono Yasui, the first Japanese woman to receive the degree of doctor in Science are also shown.

KEYWORDS

History of Chemist; History of Pharmacy; History of Science; first scientific women in Japan; Chika Kuroda; Kono Yasui.

INTRODUCTION

This article, framed in the studies on Science in general in Japan, has the main objective of showing the biography of Chika Kuroda, the first Japanese woman to obtain a degree in Chemistry in her country, in the first decades of the last century and also the second woman to obtain a PhD in Science in 1929. Some sources point out that she was also pharmacist, although this fact is not properly documented.

In order to contextualize the situation in which Chika Kuroda, a woman, decided to start university studies in her country, Japan, at that time an empire and therefore being subject to the laws and decrees that emanated from the emperor, it is convenient to indicate, in the first place, that in Japan, the Ministry of Education was established in 1871 with a school system that followed the North American model of studies although with a centralized control system copied from France (Figure 1). The Buddhist temple schools at neighborhood associations were nationalized as primary schools. Those of feudal dominion became schools of secondary education, and the Academy of the Tokugawa shogunate became the base of the Imperial University of Tokyo (nowadays University of Tokyo).

After several modifications made, the Imperial Education Decree of 1890, together with a high centralized government control in education, were the guide of Japanese education until the end of World War II. Thus, the primary school became compulsory from 1872, the secondary schools were preparatory schools for those students destined to enter one of the Imperial Universities and the Imperial Universities aimed to create westernized leaders who could be fit to lead the modernization of the country. It was the Minister of Education Inoue Kowashi who first promoted female education through an exclusive school system for girls in 1907 (Khan, 1998).

It was within this educational context when Chika Kuroda was the first Japanese woman to graduate in Science. in the Chemistry section, more specifically.



Figure 01. Headquarters of the Ministry of Education in Tokyo in 1902. Source: (web Image 1)

MATERIALS AND METHODS

Materials

Kuroda was born on March 24, 1884 in Matsubara, in Saga Prefecture (Japan), located on the island of Kyūshū (Figure 2). Her father, who was a modern and progressive person for the time, which was unusual in those days, encouraged her to train properly.

Figure 02. A typical Matsubara construction. Source: Wikipedia images

Kuroda studied at the Women's Department of the Saga Normal School, graduating in 1901. After working there for a compulsory year as a teacher, at the age of 18 she entered the Science Division of the Rika Women's Normal School in 1902 (the highest level for women at that time), graduating there in 1906. The reason she had for choosing Science as her subject was because she concluded that she would only be able to perform laboratory experiments at school. That same year she worked as a teacher at the Fukui Normal School.

Until graduation, the studies that Kudora had completed produced a strong interest in Chemistry and motivated her to want to move to a higher level, so after graduation, at 23 years old, she enrolled in the graduate program at the Normal School Kenkyuka Women's High School in 1907. After completing her undergraduate degree in 1909, she became an assistant professor at the Tokyo Women's Higher Normal School (Figure 03).



Figure 03. Chika Kuroda. Source: (Web Image 3)

In 1913, when Tohoku Imperial University became the first of Japan's Imperial universities to accept women as students, Kuroda was admitted to the Department of Chemistry at the University of Science, thus forming part of the first group of women who agreed to that university. Her mentor was Professor Rikō (Toshiyuki) Majima (1874–1962), who was the one who aroused her interest in Organic Chemistry, particularly in natural colorants (web1), since Majima (Figure 04) was conducting research on the purple pigment from *Lithospermum erythrorhizon*.



Figure 04. Professor Riko Majima. Source: (Web Image 4)

Recall that *Lithospermum erythrorhizon*, commonly called purple gromwell, red gromwell, red-root gromwell and redroot lithospermum, is a plant species in the genus *Lithospermum*. It is called zǐcǎo in Chinese, jichi in Korean, and murasaki in Japanese

(Figure 5). The dried root of *Lithospermum erythrorhizon* (*lithospermum root* or *Lithospermi Radix*) is a Chinese herbal medicine with various antiviral and biological activities, including inhibition of human immunodeficiency virus type 1 (HIV-1).



Figure 05. El *Lithospermum erythrorhizon*. Source: Imágenes de wikipedia

Thus, Kuroda completed her Bachelor of Science in 1916, becoming the first Japanese woman to achieve such a degree (Haines and Stevens, 2001). As indicated, she specialized in Chemistry, (Haines and Stevens, 2001). Although other sources indicate that she was also a pharmacist (Macho, 2017), this last information is not confirmed by official documents.

After her graduation, Kuroda was appointed Assistant Professor at Tohoku Imperial University and Professor at Tokyo Higher Normal School for Women in 1918. That same year, she was the first woman to lecture at the Chemical Society of Japan, presenting her quest in the pigment of *Lithospermum erythrorhizon* (Haines and Stevens, 2001).

Later, Kuroda studied at the University of Oxford, between 1921 and 1923, researching derivatives of *phthalonic acids* with William Henry Perkin and after those two years she returned to Japan to work as a teacher at the Tokyo Higher Normal School for Women. In 1924, she was commissioned by the RIKEN Institute (Institute of Physical and Chemical Research) to investigate the structure of *cartamine*, the pigment of safflower plants (*cartamine* is a natural red pigment derived from safflower, also called safflower, among other vernacular names (Figure 6). It is used as a textile and food coloring and as an additive it is known as Natural Red 26. Safflower has been cultivated since ancient times, and *cartamine* (Figure 07) was used as a colorant in Ancient Egypt).

The result of this research was her PhD. thesis, entitled "The Constitution of *Cartamine*", which allowed her to obtain a PhD in

Science in 1929 (web1), becoming the second woman in Japan to receive such a degree, after Kono Yasui (Kodate and Kodate, 2015).



Fig 06A.

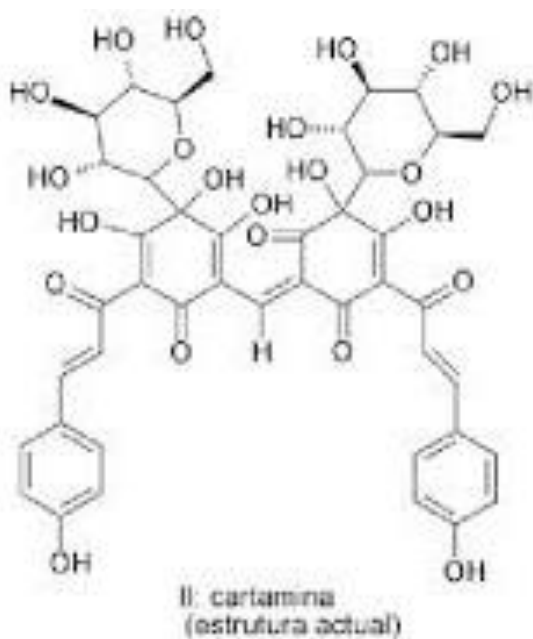


Fig 06 B.

Figures 06A. and 06B. Safflower (left) and the chemical constitution de la cartamina (right). Source: Wikipedia Images

Due to the parallelism of her professional life with the one of Chika Kuroda and because of her relevance as a pioneer of women's university studies in Japan, we are going to make a small stop in Kuroda's biography to indicate that Kono Yasui, born in the prefecture from Kagawa on February 16, 1880, thus 4 years older than Kuroda, she was the first Japanese woman to receive a Doctor of Science degree in Japan, in 1927.

Born in Kagawa prefecture, Japan, in 1880, Yasui (Figure08), like Kuroda, grew up in a society built around the ideal embedded in the educational system of women as wives and mothers. As a child, she attended girls-only schools where, instead of being taught science, math, and engineering like boys, she was trained to become a "good wife and mother." Recall that higher education opportunities for women in Japan were extremely limited, especially in the elite imperial universities, where women were excluded until 1913.

However, her family always encouraged her to pursue higher education. She studied science and mathematics at Tokyo Women's High School, where she became, before graduation, the first woman to publish a scientific article in a Japanese journal. She obtained a position as an assistant professor at that school and despite the limited means available to her, she began to do research in plant cytology, publishing her discoveries about the floating water fern *Salvinia natans* in a British botanical journal in 1911, thus becoming the first Japanese woman to publish in a foreign scientific journal.

As she wished to continue studying but was not allowed to enter the Imperial Universities because of her gender, the Tokyo Higher School for Women in which she worked asked the Ministry of Education of Japan to provide funds so that she could study abroad. The Ministry of Education rejected that request until a prominent Japanese scientist, Kenjiro Fuji, advocated for it, and the Ministry offered a compromise: They would support their education abroad on two conditions. The first, that she added "home economics" to her area of study. And the second, that he never married.



Figure 8. Kono Yasui. Source: Source: (Alemañy, 2021)

Despite these hard and unusual conditions that the Ministry had imposed on her to study abroad, Yasui accepted them and went to study first at the University of Chicago and later at Radcliffe College, at Harvard University. There she began researching charcoal, discovering six ancient plant species and unraveling the processes by which living plants transform into charcoal. Upon her return to Japan, she went on to teach again at the Tokyo Women's High School (Figure 09).



Figure 09. Kono Yasui. Source: Source: (Alemañy, 2021)

Soon after, the Imperial University of Tokyo recognized its mistake and awarded her a Ph.D. in 1927, despite the fact that she was not officially a student. This made her the first Japanese woman to earn a Ph.D. in science. In addition, that University to honor her, as the same as Chika Kuroda, the second Japanese woman to obtain a scientific doctorate, established the Yasui-Kuroda Scholarship to support women studying natural sciences. In addition, she transformed the Tokyo Women's High School into a women's research university (renamed Ochanomizu University), where she became a research professor (Figure 10).



Figure 10. Kono Yasui teaching in the Ochanomizu University. Source: (Alemañy, 2021)

Yasui studied plant genetics and the effects of nuclear consequences on plants, publishing 99 articles before retiring in 1952. As a result of her career and research, Yasui, a biologist and cytologist, was awarded the Medal with Purple Ribbon and the Order 3rd Class Precious Crown Award (Kuroda would also obtain it later) for her academic achievements and leadership in women's education in Japan. She passed away on March 21, 1971 in Bunkyo, Tokyo, Japan.

Returning to Kuroda's biography, in the 1930s and 1940s she investigated Asian pigments, eggplant skin, black soybeans, red shiso leaves, curl leaves and spines, as well as naphthoquinone derivatives (Web1). Between those two decades she was awarded the Majima Prize of the Chemical Society of Japan in 1936.

In 1949 she was appointed a professor at Ochanomizu University, where she began researching onion skin pigmentation. Her extraction of quercetin crystals from that skin made it possible to

create “Kerutin C”, an antihypertensive drug (Haines and Stevens, 2001) and (web1).

Kuroda (Figure 11 shows some images of her) retired in 1952, although she continued for some time to lecture at her University as Professor Emeritus, being awarded the Medal with Purple Ribbon in 1859 (these Medals of Honor are awarded by the Government of Japan to individuals who have performed meritorious acts or to those who have achieved excellence in their field of work. They were established on December 7, 1881, and were first awarded the following year. The design of the medal for the six types is the same, with the stylized characters on a central golden disc surrounded by a silver ring of cherry blossoms on the obverse, differing only in the colors of the ribbon: red, green, yellow, purple, blue and dark blue).



Fig 11A.



Fig 11B.

Figure 11A. & 11B. Two images of Chika Kuroda. Source: (Macho, 2017)

In 1967, shortly before she became ill with heart disease, she was awarded the Order of the Precious Crown of the Third Class, passing away a year later, on November 8, 1968, in Fukuoka, at 84 years (web1).

Figure 12. shows the three first Japanese women who dared to study at University, facing the rigid customs of the Japanese society of the time, that did not consider these studies suitable for women. They are Chika Kuroda, Raku Makita (later graduated in Mathematics) and Ume Tanfe (graduated in Chemist), who on August 16, 1913 had the honor of being the first three women admitted by the University in Japan (Tohoku University) to carry out university studies. In response to that date, on August 16 of each year the University Woman's Day is commemorated in that country.

However, a later research by Yukawa demonstrated that after 1913 no other female student was admitted by Tohoku University in the following ten years. Due to the government was clearly opposed to the idea and considered that its first decision had been premature. It was in 1923 that Tohoku and another private university, Doshisha, in Kyoto, registered women as full-time undergraduate students.

Between 1913 and 1923 women were allowed to become non-regular students or guest auditors at the universities of Toyo, in 1916, Hokkaido Imperial, in 1919, and Kyoto Imperial, Waseda and Keio, in 1921 (Kodate and Kodate, 1916).



Figure 12. Three of the first university women of Japan. Source: (Web Imag 12)

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