

snails also decreased and the habitation restricted.

The 6th Stage: Accomplishment of the Control Program, 1972-1985

The disease entered into the resolution stage when all of the endemicity markers became negative. In 1984, the results of epidemiological surveillance showed that the risk of new infection was extremely low. In 1985, all the projects for the construction of concrete irrigation canals finished.

Yurimin was known to be effective as the molluscicide originally reported by Dr. Toshihiko Iijima of the Institute of Health and was used as a supplement to Na PCP in some areas after 1968. In 1972, Na PCP was banned because of its toxicity in water, making yurimin the only one available for practical usage. Yurimin was prepared in granular powder form so was relatively easy to deliver to the field using a simple machine compared with the automated spraying machine used for Na PCP. On the other hand, an uneven distribution of chemicals was reported in the field. Also there were several reports of fish and rice damage. In 1975, Mr. Noriaki Kajihara confirmed the efficacy of B-2 (2,5-dichloro-4 bromophenol) and its safety for humans and animals by performing field trials. B-2 was adapted as the major molluscicide after 1977. At first the B-2 preparation was a powder type, but in 1981, the preparation was changed to 25% solution that could be applied by spraying machine. B-2 was used until the end of the snail control operation in 1995, and there was no report of water pollution. After the suspension of Na PCP use, the inhabitants noticed that the effect of the new chemicals was not as dramatic as Na PCP. Even after extensive education regarding the new concept of snail control and the importance of natural protection and safety of foods and human health, people did not fully understand why such non-effective chemicals should be used. Moreover, the number of patients drastically decreased by that time, so they were not as interested as before. In 1970, in Usui Marsh of Tatomo-cho, infected snails were detected and snail control was done immediately. In 1971, there were no snails. In 1972, infected snails were detected again and the snail habitation area was located. The snails were infected with schistosome through the year at an average of 4.3%, and 31.9% of the captured wild mice mainly composed of Hata-nezumi were infected. The inhabitants in the town made a request to the prefecture asking for the Usui-Marsh to be drained and buried by the modification of the river for the eradication of schistosomiasis. Usui Marsh was famous as a place where the birds rested during migration. There was a heated discussion between the inhabitants and the wild bird society on the con-

flict of disease control versus protection of nature. The discussion, symbolized by the question "Human life or wild birds?", developed in the prefectural assembly because the governor proposed a prefectural plan to locate a big project in Usui Marsh that included commercial and residential quarters and a park. Finally, the construction and modification plan requested by Tatomi town was approved by the assembly in 1976. Now we can not see the previous landscape anymore.

In 1981, Dr. Masaru Minai from the Prefectural Institute of Hygiene visited Leyte Island in the Philippines and established the biological method to detect contaminated water by immersing a mouse for two hours per day for 3 days. He applied this method to the endemic area in Yamanashi. In 1982, he found a positive test result in Tatsuoka town of Nirasaki city, but no new patients, infected snails or infected wild rats were detected in the follow-up investigation. The two examples of Usui Marsh and Tatsuoka of Nirasaki City strongly suggested that the schistosome life cycle had been maintained in some parts of the prefecture even after no new infection was reported. During the period between 1972 and 1985, the percentage of positive skin tests and egg positivity were constantly decreasing and reached less than 10%. In 1977, the three persons (0.03%) reported to be fecal egg positive became the final patients with new infection in Yamanashi. In 1984, national surveillance for schistosomiasis revealed no infected patient, snails or animals, although there were many skin test and ELISA positive cases as shown in the following table.

Test	Tested Samples	Positive cases	%
ELISA	814	182	22.4
Fecal examination	182	0	0
Skin test	5,389	873	16.2
Past history	5,389	1,888	35.0
Snail	57,155	0	0
Wild mouse	120	0	0
Immerging test	531	0	0

Table 1. The results of the national survey in 1984.

The surveillance committee concluded that there is no possibility of a future epidemic in the previously endemic areas in Yamanashi, but that to maintain this situation and to eradicate the disease, the prefecture should continue its efforts to completely eliminate the snails and to survey the infection. The construction of concrete irrigation canals promoted since 1950 completed the program after the final project of maintenance of damaged irrigation canals in 1985. After the national survey in 1984, the prefecture decided to maintain the activities for the surveillance even if no new

active infection was reported.

The 7th Stage: Surveillance and Disease-free Declaration, 1986-2000

We continued the control program, especially focusing on surveillance even after all the epidemic markers showed negative. After the disease-free declaration in February 1996, the surveillance was maintained for five more years.

Since it was possible that some life cycles might remain in the prefecture, the control project was maintained until 1995, 13 years after the final case report. Since 1981, the patient detection was performed by three step examinations including skin test, ELISA and fecal examination, although after 1984 the skin test was eliminated. The following table summarizes the results during this period.

Examination	1986-90	%	1991-95	%
Fecal exam	0/1,544	0	0/135	0
ELISA adults	2,616/19,739	13.3	254/6,232	4.1
School child	0/1,702	0	0/5,170	0
Infected snails	0/283,412	0	0/154,152	0
Immersion test	0/3,124	0	0/778	0
Wild rats	0/90	0	0/30	0

Table 2. Surveillance and detection between 1986-1995

	1996	1997	1998	1999	2000
ELISA	0 %	0	0	0	0
snails	0 %	0	0	0	0
immersion	0 %	0	0	0	0
Density snails/ 25 cm ² × 25 in 120 different place	13.3	8.2	9.1	10.4	20.5

Table 3. Surveillance after the declaration (1996-2000)

The seropositive persons were all above the age of 41 years, and the test results for school children in 1991 were all negative, indicating that there was no new infection since 1982. In March 1995, the governor formed a special committee named the Regional Disease Eradication Promotion Committee to give suggestions for the direction of future policy of the control program after the results of the 10-year surveillance showed that there had been no new infection for ten years. The committee reviewed all the accumulated data for ten years and made the following suggestions.

1. Schistosomiasis has been eradicated in Yamanashi Prefecture.
2. The control program has reached its final goal and does not need to continue.
3. Some new surveillance mechanisms are necessary to safeguard against the re-emergence of the disease due to

the remaining snail habitation.

In February 1996, after receiving these suggestions from the committee, Governor Takeshi Amano officially declared that the regional disease (*Schistosomiasis japonica*) in Yamanashi Prefecture was eradicated. The suggestions pointed out the necessity to maintain surveillance even after the declaration. The governor launched a new surveillance project for five years including town meetings for the explanation of the present policy of control and the continuation of surveillance. Snail surveillance was performed by two different methods. One is the classical examination of snails that were collected and submitted to the town and the prefectural institute of health by the farmers and surveillance officers. The other was a sentinel surveillance system in which 120 different places in the rice field area along the Kamanashi River were selected to monitor the snail habitation. The sentinel surveillance was continued from 1996 to 2000. During the surveillance period, the total number of snails within a 25×25 cm square at two points in the sentinel rice field was counted. The results of the surveillance were all negative as shown in the table. The density of the snail habitation observed by the sentinel surveillance increased after the termination of snail control. Along with the snail surveillance, a social conceptional study, issue-deposited egg examination survey, and chronic schistosomiasis survey were performed at the suggestion of the Regional Disease Surveillance Program Committee (Chairman: Toshihiko Iijima, Professor of Kyorin University, Members; Yutaka Inaba, Professor of Juntendo University, Tsuyoshi Kurata, Vice Director of National Institute of Infectious Diseases, Moriyasu Tsuji, Professor of Kyorin University, Yasuo Nakajima, Professor of Yamanashi Medical University, Yukio Hosaka, Visiting Professor of Tokyo Medical and Dental University, Kiyoshi Makiya, Associate Professor of Sangyo Medical college and Hiroshi Yokoyama, ex-President of Prefectural Central Hospital). The detailed study on the inhabitants' concept of the disease was conducted by the Prefectural Health Promotion Office (Head: Masahiro Kaminota, Officers: Masahiro Okubo, Shigeo Watanabe) and showed that 88% of the examinees expressed an emotional fear of the disease and 43% an anxiety that the area might become endemic again even after an effective medicine (prasiquantel) was available. Even now (2003), the inhabitants still remember the scourge of the disease. A total of 33% of the examinees wanted the snail surveillance to continue, 43% agreed to reducing the size of the control, and 12% agreed to suspending the surveillance (see the statistics section of this volume). Surveillance of the tissue-deposited eggs showed 139 positive cases (0.56%) out of 24,950 examinations during five years. The detected eggs were all dead and only from persons over

54 years old in 1996. Finally, 292 hospitals and clinics in Kuninaka district were surveyed for new patients and the result was negative.

On February 15, 2001, the regional disease surveillance program committee submitted a report saying that,

1. It is not necessary to continue the surveillance activity from the medical standpoint. However, since the inhabitants are still anxious about a possible epidemic, the public sector should consider the continuation of examinations regarding the possible origins of re-emergence.
2. To solve the anxiety of the inhabitants, educational programs on schistosomiasis should be conducted continuously.

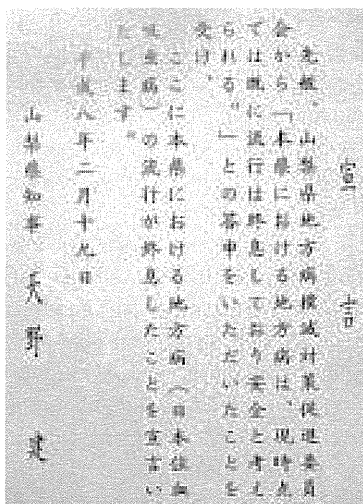


Figure 4. Governor of Yamanashi Prefecture, Mr. Takeshi Amano declared the eradication in 1996.

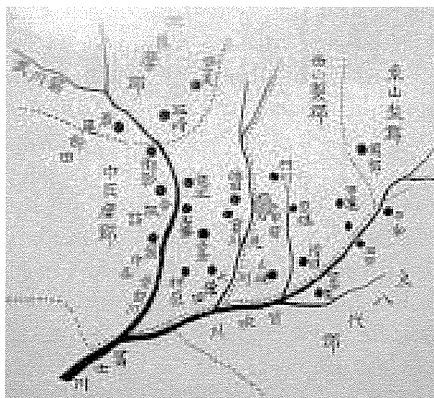


Figure 5. The map of Kofu basin, an endemic area of schistosomiasis around 1904 (I. Tsuchiya, K. Tohyama, Yoko .Med. Ass. J. 9 (3), 1904

1. Until the Discovery of the Pathogen

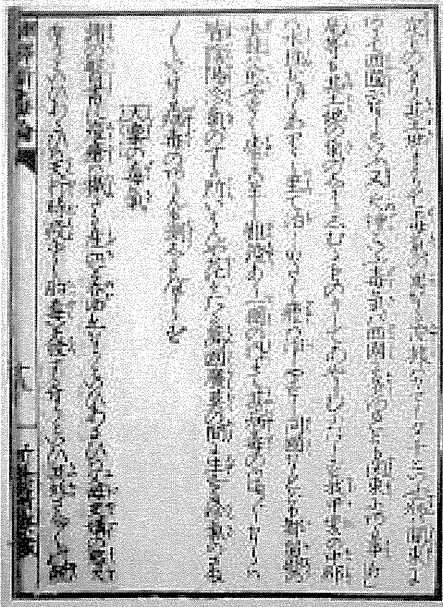


Figure 6. *Honyaku Dandoku Ron* or “Translated Toxicology” (1811)
Hakuju Hashimoto, a medical doctor living in Ichikawa Daimon Village, Yamanashi, described that there were many patients with ascites who were very difficult to cure. (Prefectural Library)

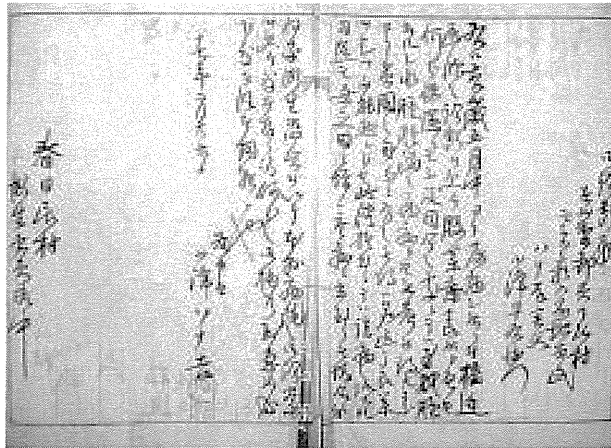


Figure 7. Request for diagnosis (1884)
The letter to the health officer at Kasugai Village from the son of a patient with schistososomal liver cirrhosis. (Prefectural Library, Kofu)

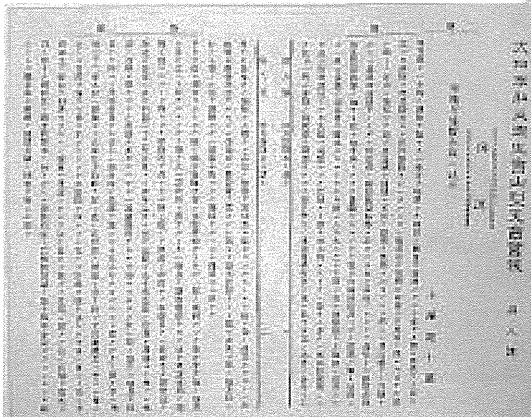


Figure 8. The first academic report published in 1897. Shika-Juro Ozawa, on the regional disease characterized by ascites.

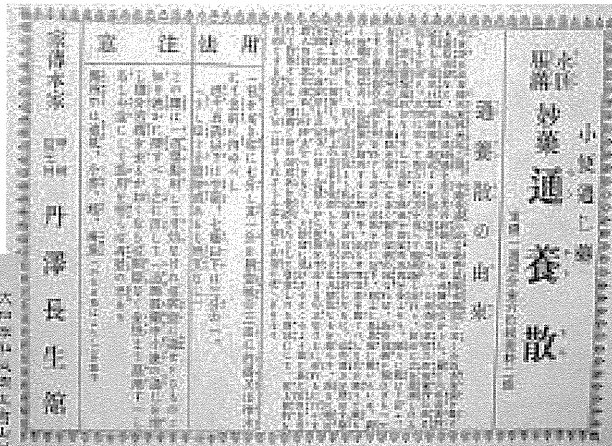


Figure 9. Advertisement for *Tsu-Yo-San* (diuretic) a medicine effective for advanced schistosomiasis, around 1900. (Prefectural Library, Kofu)

2. Contribution of Naka Sugiyama - 1 -

Before the findings of schistosoma in 1904, a lady farmer, Naka Sugiyama, who died of schistosomiasis donated her body for autopsy in 1897.

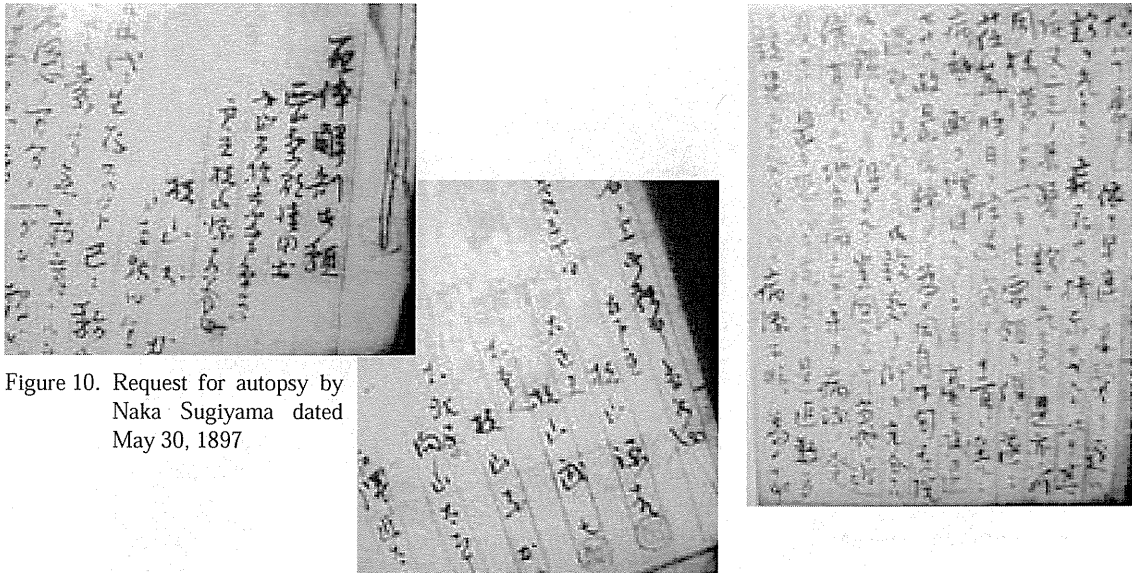


Figure 10. Request for autopsy by Naka Sugiyama dated May 30, 1897



Figure 11. Junsaku Yoshioka (1868-1955), a physician who took care of Naka Sugiyama and was asked by her to perform an autopsy. He helped to build the memorial monument to Naka for her goodwill.

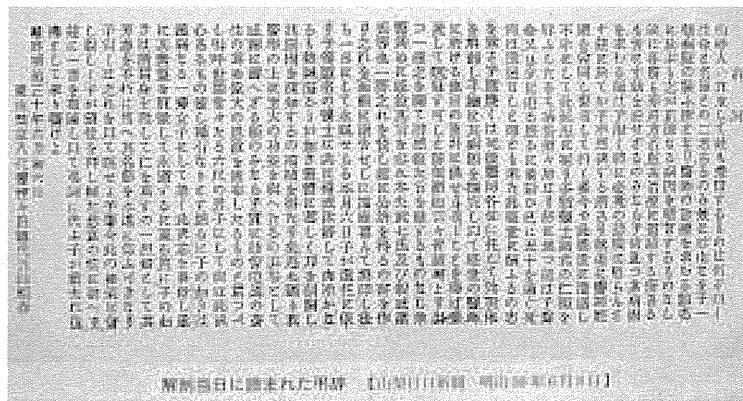


Figure 12. An article on the autopsy published in a local newspaper. (Yamanashi Daily News, 1897)

Contribution of Naka Sugiyama - 2 -

Naka's autopsy was performed on the day after her death, in Seigan-ji, the Sugiyama family temple.



Figure 13. Dr. Yosai Shimodaira performed the autopsy.

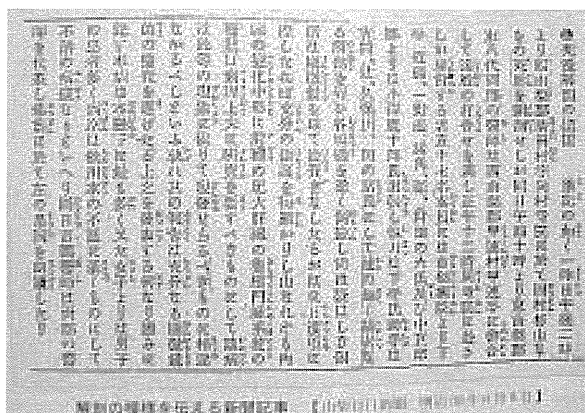


Figure 14. The news report on the autopsy.



Figure 15. Naka's daughters stand to the left of the monument at the opening ceremony. The memorial monument established in 1912 in the garden of Seigan-ji Temple was donated by the Medical Association of Higashi-Yamashiro county, Yamanashi.

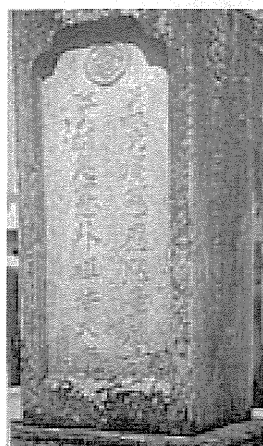


Figure 16. The gravestone of Naka Sugiyama and her husband.

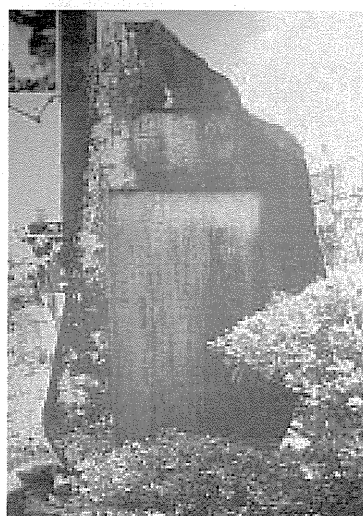


Figure 17. The memorial monument to Naka Sugiyama built in 1912, 15 years after the autopsy.

3. Discovery of Schistosoma

In 1904, Prof. Fujiro Katsurada collected the novel helminth *Schistosoma japonicum* from a cat liver with Dr. Saburo Mikami, a general physician in Ohkamata Village (Kofu City at present).



Figure 18. Professor Fujiro Katsurada (1867-1946)
In 1904, he found *S. japonicum* and in 1909 showed the skin penetration of cercaria using dogs.

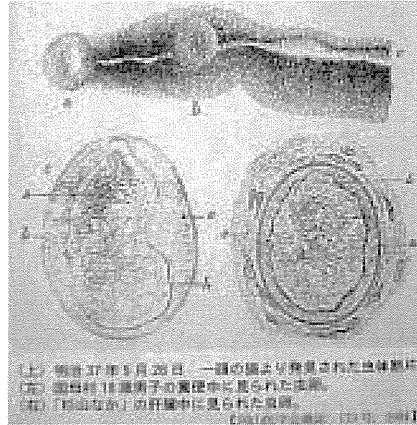


Figure 19. Above: The head of the worm.
Lower left: Eggs from the feces of an 18 year-old boy in Kokubo Village.
Lower right: The egg found in the liver of Naka Sugiyama.

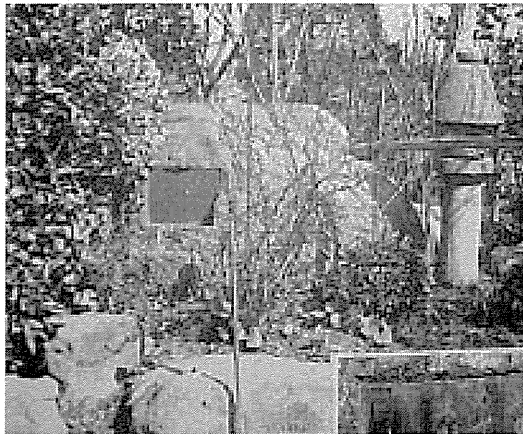


Figure 20. The monument commemorating the discovery of schistosome erected on July 30, 1904 in the garden of Mikami Clinic in Kofu.

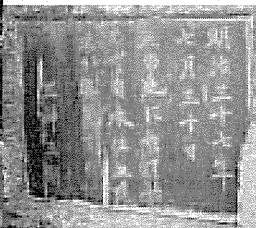


Figure 21.
Dr. Saburo Mikami (1873-1958), who helped Prof. Kasturada. He showed that stibunal was effective by clinical trials in 1923.



Figure 22. The house where prof. Kasturada stayed while searching for schistosome, located beside Mikami Clinic in Kofu, Yamanashi. (Taken in 1972)

4. Research team

The Yamanashi Prefecture Medical Association established the department of regional disease research in 1909. The first disease survey was conducted in 1911.



Figure 23. The research report in 1911 emphasized that covering of the skin with cotton cloth was effective for prevention.



Figure 24. Iwaho Tsuchiya (1878-1928)

In 1910, Tsuchiya became the first expert technician in the department of research. He made great scientific contributions to the control. Later, he was appointed the Emperor's personal physician and was elected to the National Diet in 1927.



Figure 25. The 3rd report in 1911 on the hepato-splenic disease in Yamanashi.



Figure 26. The report submitted in 1912. Amazingly, the sterilization trial of the rice field using quicklime and nitrogenous quicklime was performed before the finding of the intermediate host, oncomelania by Miyairi.

5. Discovery of Oncomelania, the intermediate host

In August 1913, Prof. Keinosuke Miyairi and his colleague Minoru Suzuki found the intermediate host of *S. japonicum* in Saga Prefecture. In September the same year, Tsuchiya and Miyairi confirmed the same snail in Kokubo village and in Showa in Yamanashi.



Figure 27. Prof. Keinosuke Miyairi (1865-1946) Miyairi discovered the intermediate host in 1913. In 1916 he conducted health surveillance in the agricultural villages in Yamanashi.

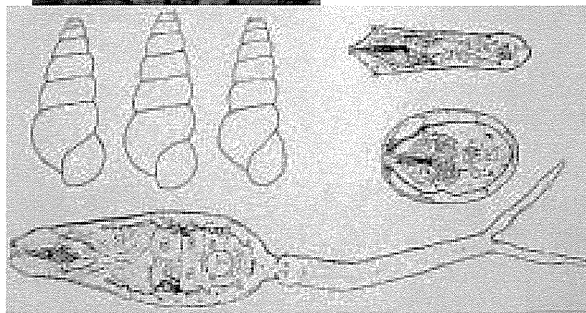


Figure 28. Oncomelania snails, miracidium, egg and cercaria, hand-drawing by Prof. Miyairi (1914).

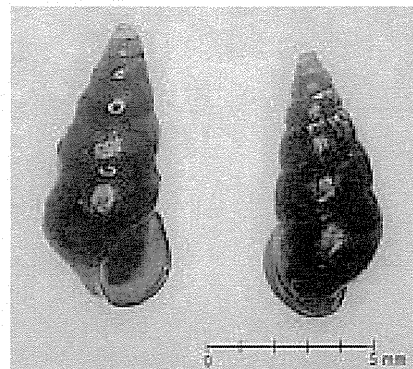


Figure 29. Miyairi snail (Katayama snail) Adult snail is 8 mm in length.

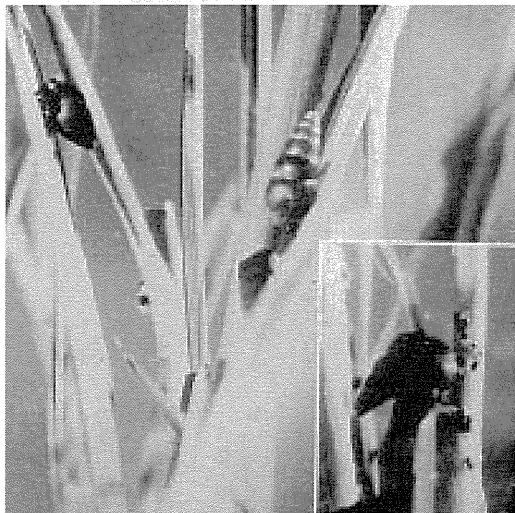


Figure 30. The snail climbing up a rice stalk.



Figure 31. The monument commemorating Prof. Miyairi's academic achievement in Saga Prefecture (Sonezaki Town, Tosu City).

6. Molluscicide by Quicklime -1-

In 1925, the Cooperative for Schistosomiasis Eradication in Yamanashi was established, and the snail control program using quicklime was started following the methods adopted in Hiroshima.



Figure 32. A Brazilian expert group visited Yuda town and Tamaho village in 1926 and observed the molluscicide activity using quicklime.

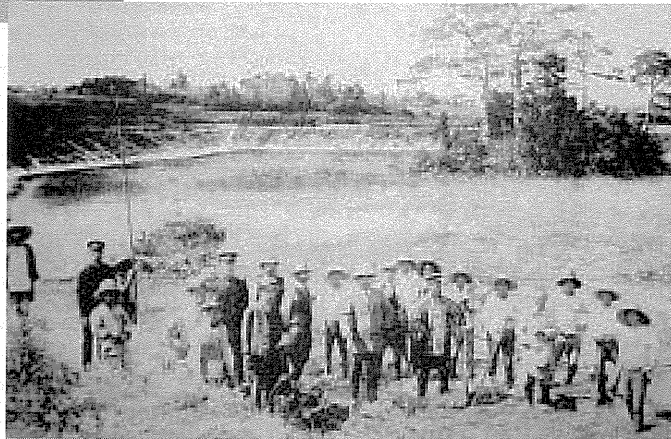


Figure 33. Governor Shintaro Suzuki visited the field at Tomi-village water reservoir in 1928.



Figure 34. Quicklime molluscicide in the field (1928-1930) at Narita Block South (Donated by Mr. Ikuo Kitta).

Molluscicide by Quicklime -3-

These three photographs provided by Dr. Chuzo Mitsui, included in the book "Outline of Schistosomiasis Research and Field Control in Yamanashi" published by Tatsuo Kato in 1940, were taken around 1938.



Figure 38. Scraping the both sides of the irrigation canals to drop the snails.



Figure 39. Application to the canals of quicklime.



Figure 40. Stirring with a long-arm scraper.

Molluscicide by Nitrogenous Quicklime -1-

Due to the rise in price, quicklime was replaced by nitrogenous quicklime in 1941.

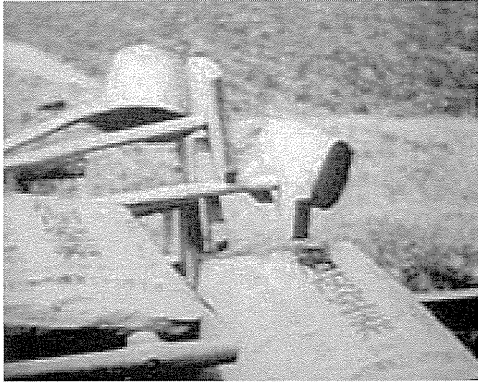


Figure 41. Nitrogenous quicklime used in the snail control program.

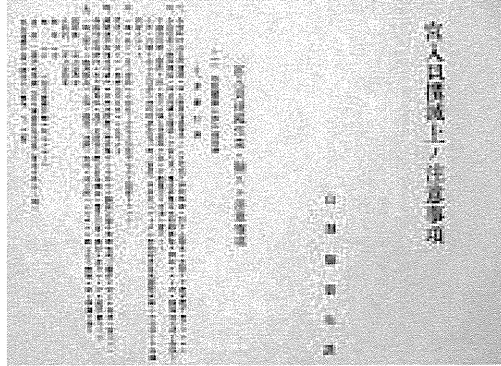


Figure 42. The circular cautioning users before the application of nitrogenous quicklime (1943).

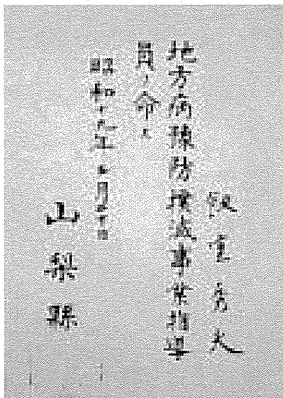


Figure 43. The certificate of instructor of the eradication program in 1944. (Donated by Mr. Hidenori Mochizuki)



Figure 44. Scraping the edge of the irrigation canals to drop the snails into the water.



Figure 45. Application to irrigation control in 1943.

Molluscicide by Nitrogenous Quicklime -2-

Nitrogenous quicklime was used exclusively until 1952 and continued to be recommended around 1957.



Figure 46. Application to the rice field.

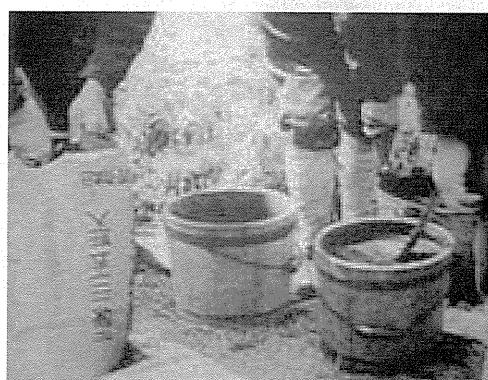


Figure 47. Preparation of the nitrogenous quicklime (1943).



Figure 48. A long-arm dipper was used to spread the preparation on the wall of the canal.

項目	内容	担当者	実施日
1. 準備
2. 配布
3. 実施
4. 報告

Figure 49. Operating procedure of the molluscicide activity distributed to instructors in 1943 (Courtesy of Mr. Hidenori Mochizuki).

8. American Occupation Period - 1 -

The general headquarters of the American Occupation Forces in Tokyo (GHQ) sent a research team to Yamanashi in October 1945, just after the end of the war. In 1947, the US Army 406 Medical General Laboratory opened a schistosomiasis research division in the Prefectural Hall in Kofu.

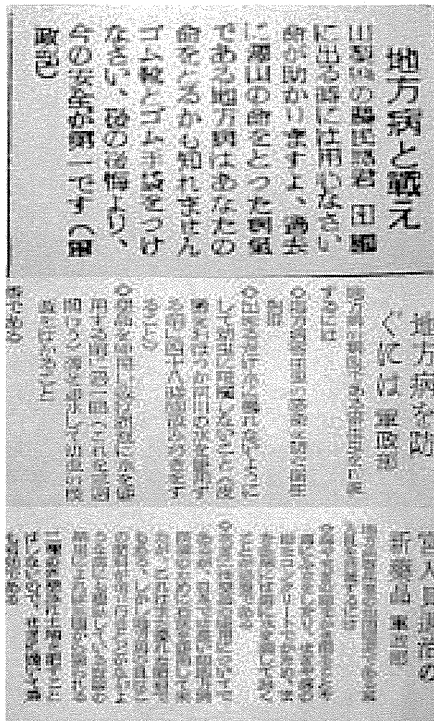


Figure 50. Anti-schistosomiasis campaign newspaper advertisement sponsored by the American Occupation office in Yamanashi in 1948.



Figure 51. Dr. McMullen examines the effect of molluscicides (1950).

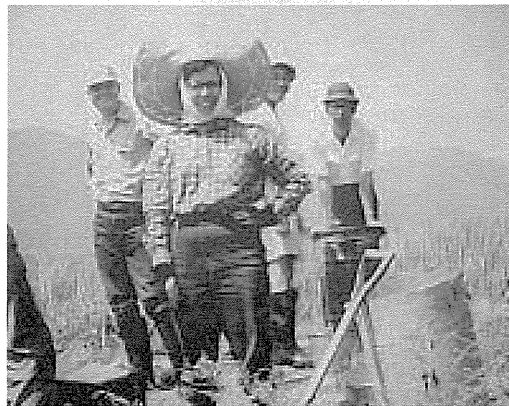
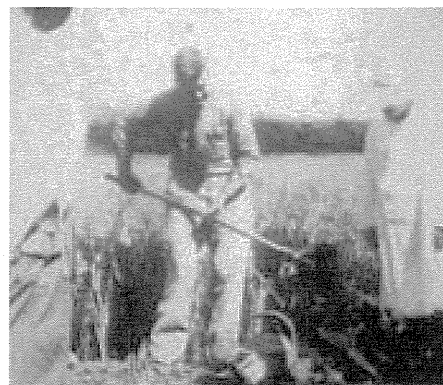


Figure 52. Snapshot of a field trial of molluscicide in 1955 in Nirasaki City (Courtesy of Dr. Toshihiko Iijima).



Figure 53. Dr. McMullen watches the field application of molluscicides in Nirasaki in 1955 (Courtesy of Dr. Takashi Sasaki).



American Occupation Period - 3 -

The Japanese and US governments adopted schistosomiasis in Yamanashi as a special research issue for cooperation. The 406 MGL (US Army 406 Medical General Laboratory) prepared a laboratory train for the fecal examinations.

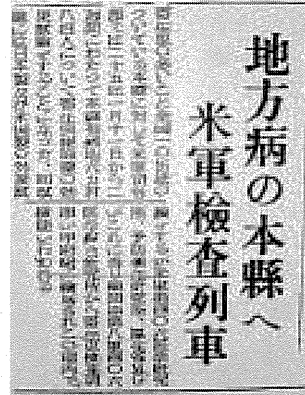
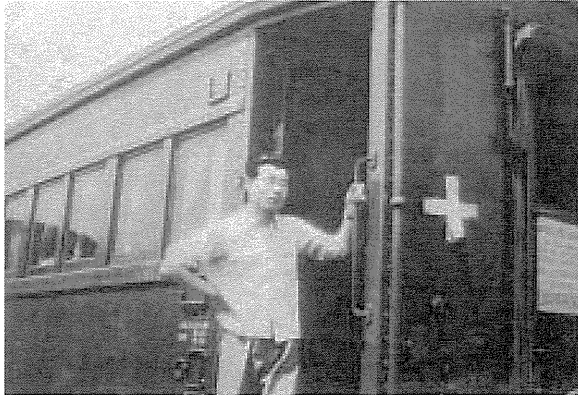


Figure 58. The so-called "parasite train" and its name plate.

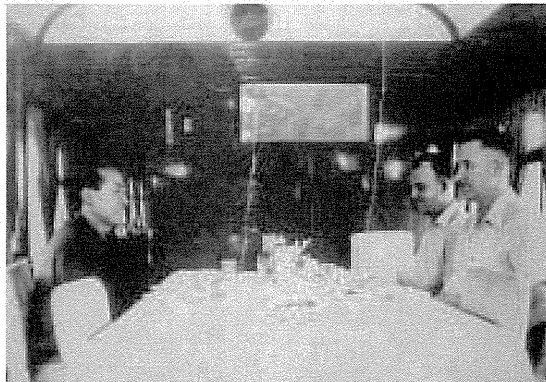
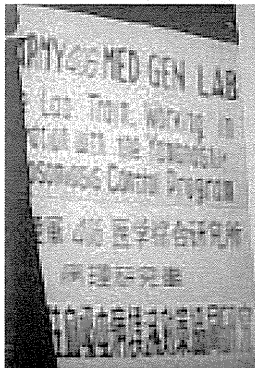


Figure 59. Dining car on the parasite train. Three American experts (Drs. McMullen, Richie, Pan) confer at Kofu station.



Figure 60. Inside the parasite train.

9. Molluscicide by PCP - 1 -

In 1954, after the field trials in the prefecture, the local government decided to apply NaPCP as a new molluscicide because it was cheaper and more effective. Initially, however, there were many cases of fish death due to high toxicity.



Figure 61. The newspaper reported the arrival of the new molluscicide compound, NaPCP, or "Santo Bright".

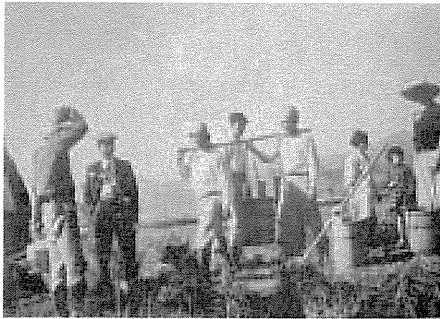


Figure 62. The field application of NaPCP in 1955 (Courtesy of Dr. Takashi Sasaki).



Figure 63. Spraying NaPCP in 1965 in Hatta village.



Figure 64. NaPCP was initially applied by scoop and watering pot in 1955.

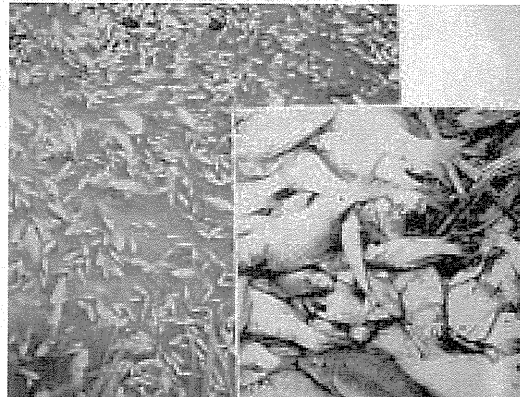


Figure 65. Fish died in the river and the raising pond at the beginning of the application due to excessive use (1954-1958) (Courtesy of Dr. T. Iijima).

9. Molluscicide by PCP - 2 -

Improvement of the application of NaPCP decreased the negative impact on fish. The enthusiastic and comprehensive snail control activities using the molluscicide produced disease-free areas in 1960 and 1961, and the total area of the snail habitation began to decrease.



Figure 66. Molluscicide group organized by volunteers in Sakaigawa village around 1960.



Figure 67. The application of liquid form NaPCP.



Figure 68. Dissolving the powder in water (1955).



Figure 69. The application of NaPCP using a spray pump, in 1968 in Ryuo town.

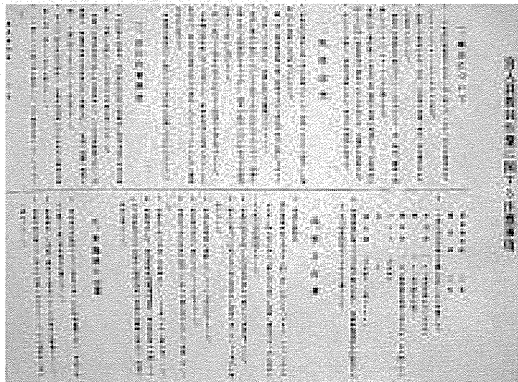


Figure 70. In 1955, the prefectural government issued warnings about the toxicity to fish resulting from the use of NaPCP as a molluscicide.

10. Concrete Irrigation Canals - 1 -

Test trials of the concrete canal were conducted in 1948 and turned into a government project in 1950. The project was accelerated after 1957 when the Parasite Disease Prevention Law was partially modified.



Figure 71. Newspaper report on the new project using concrete canals.

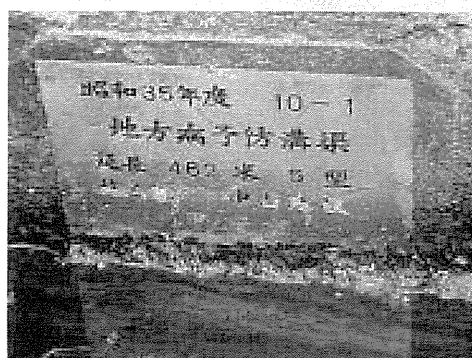


Figure 72. The name plate indicating the construction year of the canal.

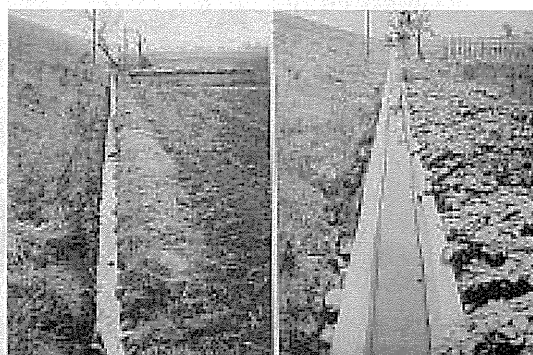


Figure 73. Before and after the construction in Wakakusa town in 1951-1952.

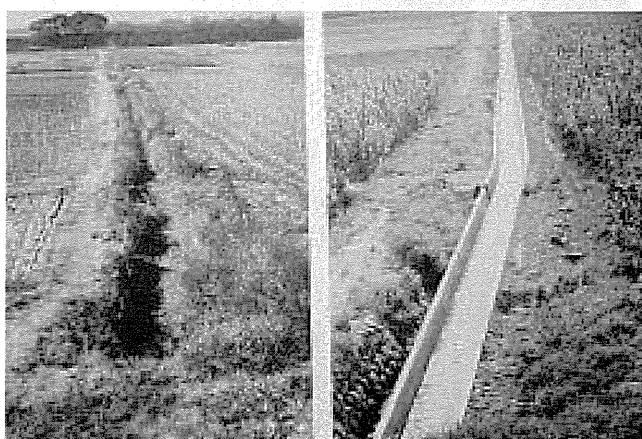


Figure 74. Before and after in Shirane Town (1956-1957).