SOME HIGHLIGHTS OF THE TRANSFER OF DUTCH MEDICAL LEARNING TO JAPAN UNTIL 1870

A glimpse of a white horse, cantering past a slit in the wall...

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"The Netherlands has contributed to new developments in Japan by the influence of her *navy*. This should be known better in the Netherlands and abroad ! The Netherlands has proved by its navy, that it intended to assist Japan truly and faithfully in the area of teaching and development, to bring the country to a higher level. It wanted to *persuade* the Japanese to drop their antiquated system of government by assisting them wherever possible in the spread of knowledge; to enable them to recognize their government".

Thus writes Jhr J.L.C. Pompe van Meerdervoort in his memories : *Vijf Jaren in Japan (1854-1859)* (1). Indeed, the Dutch contributions to the spread of knowledge in Japan culminated in the period 1855-1885, first by the foundation of the naval college at Nagasaki in November 1855 by the first detachment under command of G.C.C. Pels van der Rycken, later by the introduction of medical teachers from the Military Medical Training College at Utrecht (2).

The first naval officer to arrive with a medical training was Johannes Lidius Catharinus Pompe van Meerdervoort. Born in 1829 in Brugge, Belgium from an aristocratic family he entered the *Mili-*

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tary Medical Training College in Utrecht in 1845, where he graduated as a medical naval officer in 1849. In 1852 he was promoted to a naval officer second class and sent with the second detachment to Japan in 1857.

Pompe van Meerdervoort introduces his memories by giving a broad survey of the history of Japan, an impressive study in which he explains the organisation of the government, the religious and worldly authorities. Furthermore, he pays ample attention to the relations with European countries, with the Netherlands in particular. Finally he gives an ethnological description of Japan, data on its geography, agriculture, hunting and fishing, its industry, mining, language and teaching.

His view upon the relations with the Netherlands mainly concerns the political and trade connections. He describes the factory of the Dutch on Deshima, after the closure of Japan in 1640 at the beginning of the *Tokugawa* Period, which would last until 1868, when the *Meiji Restoration* began. In this period, the *Rangaku*, the Dutch learning, was introduced into Japan. Since this mainly concerned medical and scientific knowledge I would like to pay some attention to the early spread of *Rangaku*, by briefly mentioning the highlights, beginning with the magnificent work of Genpaku Sugita (1733-1817) and Ryotaku Maeno (1723-1803) published in 1774. They overcame in a heroic way the language problems, with their efforts to translate the *Ontleedkundige Tafelen*, an anatomy book which was published in 1734 by Johan Adam Kulmus (1689-1745) and translated by a Dutch surgeon, Gerard Dicten (3). This *Kaitai Shinsho* is the first landmark of the reception of Dutch knowledge; it would be followed by many more books from Dutch scholars, which were translated into the Japanese language. We must bear in mind that officially no Western books were allowed to be introduced into Japan and therefore, great care was essential regarding the spread of Dutch learning. The factory at Deshima in the harbour of Nagasaki offered the opportunity of some contacts, but there was more chance to exchange knowledge during the "Court-Journey", when the captain of the Dutch factory had to be replaced. The so called "opperhoofd" was obliged to travel to Edo to greet the Shogun, and the Dutch surgeon was expected to accompany him on this court-journey. Some

Shoguns were less strict on the rules regarding Western books, especially when the Dutch learning was dealing with important knowledge such as instruments for navigation or scientific instruments, useful for other purposes. Around 1720, under Shogun Yoshimune (1716-1745) the introduction of Dutch books on medicine, botany and astronomy was officially permitted (4). Moreover, various books were expected to be offered to the authorities as gifts, such as Dodoens' *Cruydtboek*, Heisters *Chirurgie* (5) or even dictionaries, which were of great importance for the translators, mostly interpreters at Deshima.

The surgeons who stayed at Deshima were contracted by the V.O.C., the United East India Company, which looked after the trade-interest in the Dutch East Indies. In 1799 this institute was closed down by the new rulers of the Batavian Republic, which was installed under pressure of the French revolutionary movement after 1789.

Especially during the period 1803-1813, the trading post at Deshima had to face serious problems, since the English were hostile towards the Dutch, because they considered them to be allies of the French. Hendrik Doeff (1777-1835), the "opperhoofd" of the trading post, was isolated from both the Dutch Indies (now Indonesia) and the Netherlands. During this period the Dutch were allowed to leave the island and to walk around the city of Nagasaki. The Japanese authorities even took care of their needs, since no import of necessary goods was possible. When Pompe van Meerdervoort asked the Japanese authorities why they had been so liberal and human towards his compatriots only during that period, and not thereafter, they answered him :

> "This was impossible. The Dutch always want to smuggle as soon they have the opportunity to exchange merchandise. Doeff had nothing, so he could not do any harm."

But Doeff had something, he had a Dutch-French dictionary published by Francois Halma in 1710 translated into a Dutch-Japanese dictionary, *Doyaku (or Zufu) Haruma*, with the help of the Deshima interpreters in 1816 (7). This dictionary was of great importance to the translators of Dutch medical textbooks. Actually,

Inamura Sampaku (1759-1811) had already compiled a Dutch-Japanese dictionary, the *Edo Halma* in 1796, also based on Halma's book. Therefore, "Haruma" (Halma) became the generic name for Dutch-Japanese dictionaries (8).

After 1813, when King William I of the Netherlands managed to restore the trading contacts with Japan, the diffusion of Dutch medical learning spread more rapidly. Before 1824, when Philipp Franz von Siebold (1796-1866) came to Nagasaki, there were only five schools of Dutch medical learning. In 1855, when Pompe van Meerdervoort started his teaching in the Nagasaki Hospital, there were already more than fifteen (9). These schools were private, they were organised by the feudal clans, which were eager to start a modern school for their territory. By 1871, there were 272 feudal clans in Japan, of which 95 had medical education facilities (10). The first school was founded in 1786, by Gentaku Otsuki at Edo. From this school various wellknown graduates founded other schools, for instance at Osaka, in 1798, and even two at Kyoto, in 1800 and 1801 (11). We must admire the achievements of these schools. The students were confronted with often difficult medical writings, such as Boerhaave's *Medical Institutions* and *Aphorisms* (12), Johannes de Gorter's textbook of internal diseases (13) and various anatomical treatises, which were popular for naval surgeons during the eigteenth century, but not easily accessible for the Japanese scholars, who had traditionally a different concept of the structure of the human body (14). It was for this reason that Genpaku reflects upon the problems he had to face during his lifetime. "Time flew like a white horse cantering past a slit in the wall ... (15), three or four years passed all too quickly".

The *Kaitai Shinsho* and the medical schools for Dutch learning of the feudal clans represent the *first* higlight of Japanese-Dutch medical relations. The second highlight came forth from the stay of von Siebold. Much honour has been paid by Japanese scholars to his commemoration, his botanical garden at the Narutaki district in Nagasaki has been well preserved and his statue can be found there. Furthermore, the Hosei University publishes the Siebold Kenkyu since 1982. Various new materials on von Siebold have been published by members of the von Siebold Society. In 1988, a commem-

oration exhibition "Von Siebold and Japan" was held in the national musea of Tokyo and Kyoto, including also the Nagoya City Museum. An impressive catalogue with beautiful illustrations was published for the occasion.

Von Siebold started his medical teaching at Deshima. This had been arranged by the "opperhoofd" Jan Cock Blomhoff (1779-1853). Officially ordinary Japanese doctors were not allowed to enter this island. But they could sneak in — disguised as servants to the Deshima officials, or even as an interpreter (16). Soon von Siebold was allowed to see patients and teach medicine at the private school run by Narabayashi Soken (died 1852) and Yoshio Kosai (1788-1866), descendants of famous interpreters families. By June 1824, a boarding school was built in the Narutaki section of Nagasaki which he visited once a week for clinical instruction and treatment (17). This was the first time in the history of Dutch/Japanese relations that a physician who was stationed at Deshima, was directly teaching medical knowledge to Japanese students.

We shall not go into the medical activities of von Siebold, neither into his excellent qualities as a collector and ethnograph. During his first stay in Japan from 1824-1829, he did many discoveries in the field of natural history. He studied Japanese literature and he brought together an important ethnographical collection on Japan (18). The description of this can be found in his work : *Nippon, an archive for the description of Japan*, which was published in a succession of 20 volumes from 1832-1858. As mentioned before, his *Flora Japonica* and *Fauna Japonica* are studies of a most delicate beauty (19).

The arrival of Pompe van Meerdervoort meant in more than one way a change in Japanese/Dutch relations. We should realize that the Japanese Government asked the Dutch government for a medical naval officer *directly*, by Mr H.J. Donker Curtius, the "opperhoofd" at Deshima. When Pompe van Meerdervoort started his medical teaching in 1857, he had to render an account to the Japanese government by the Nagasaki governor. Moreover, contrary to the feudal clan schools where the *rangaku* was taught by Japanese doctors, the Nagasaki school offered the direct transfer of European

medical knowledge from a Dutch physician to Japanese pupils. Von Siebold had done the same, but more as a private enterprise. Moreover, after 1853, Japan was open to other countries. The Government could decide from which country they wanted to import medical knowledge. Until the time of Pompe van Meerdervoort it had been the *rangaku*, the Dutch Learning, which was accepted in Japan. After Pompe van Meerdervoort, *rangaku* would become *ranpo* medicine, Western medicine. The Shogun could decide from which country this *ranpo* medicine could be imported.

On the other hand, also feudal clans were allowed to contract foreign physicians independently. Generally speaking, we may say that the prevalence of both the Japanese Government and the daimyo's of the feudal clans for Dutch medical doctors continued until 1869, when the Meiji Restoration opened new ways for education. In that year, the Government decided to adopt the German system of medical education. In 1876 the Government passed a regulation requiring all physicians to study Western medicine. This does not mean that the feudal clans could no longer contract Dutch physicians ! For instance, the Okayama clan contracted Franciscus Johannes Antonius de Ruyter (1841-1886) who worked at the Okayama Medical School from 23 June 1870 - 7 July 1871 (20).

The third highlight of Japanese/Dutch relations in the transfer of knowledge is without any doubt the contribution of Jhr J.L.C. Pompe van Meerdervoort, who organized *structured* medical education on a Western base (21). This was continued by his successor Anthonius Franciscus Bauduin (1820-1885), who had been a teacher at the Utrecht Military Medical College during twelve years until 1862. It may be desirable at this point to pay some attention to the medical knowledge, which was actually transfered to Japan in this period. Before going into this matter, a bird's eye view upon the Netherlands, its medical schools and its sanitary problems, should be considered.

At the beginning of the nineteenth century, Europe had been suffering under Napoleonic wars. In 1813, the Netherlands was in the same condition as poor Hendrik Doeff at Deshima : poverty, an enormous national debt and a complete isolation of the sources of its

riches : the Dutch colonies. In the field of medicine, the Dutch had been scourged by epidemics, smallpox and diphtheria. Within seventeen years, cholera would be added to this squadron of Death ! Therefore, priorities in medical care should have been prevention and sanitary decrees to improve Public Health. Only the vaccination against smallpox was realised, already in 1799. It would be advocated in this country by prominent physicians and become gradually a general practice during the nineteenth century (22).

It would take much more time before an effective prevention against cholera could be established. Hygienists, engineers and politicians were unable to take the necessary measures, especially the installation of a drinking-water system and a proper sewage system until ± 1870. So in this respect, the Dutch could offer little help to the Japanese, when cholera epidemics were inflicted upon the population, for instance in the year 1858-1859, when an American ship "Missisippi" brought the cholera to Nagasaki, and even Pompe van Meerdervoort fell ill (23). But effective vaccination against smallpox could be realized. The main problem was the conservation of the vaccine, which had to be imported from Europe or the Dutch East Indies. In spite of these problems Otto Gottlieb Johann Mohnike (1814-1887) made great efforts in 1848 to vaccinate children in Nagasaki (24). Pompe van Meerdervoort also promoted vaccination in Nagasaki. Many leading Japanese physicians contributed much to the encouragement of vaccination. The daimyo's ordered some physicians like Narabayashi Soken at Nagasaki, to consult the Chief of the Deshima trading center about the import of vaccine from Batavia. In 1850, Narabayashi Soken was able to vaccinate the son of the daimyo Nabeshima Kanso, who launched a campaign to promote vaccination. The active vaccine was passaged arm-to-arm and finally reached Edo. A vaccination office was founded there in 1858, ten years after Mohnike began its action in Nagasaki. Out of this vaccination office at Edo finally grew the Medical Faculty of Tokyo University in 1871 (25).

Besides epidemics, the Dutch were confronted with an accelerated development of medical knowledge during the nineteenth century. Around 1850, the Universities were backward in both research and teaching. The clinical schools and especially the Mili-

tary Medical Training College at Utrecht were more receptive to innovations. Laennec's stethoscope, Wunderlich's thermometer, improved microscopes and the so-called "Kunstlijk" from Auzoux, a skillfully constructed replica of the anatomy of the human body, were in daily use for care of patient and teaching (26). Various teachers of surgery at the Military Medical Training College contributed to the "veldtoestel", an instrument-case with a set of surgical instruments which could be transported on horseback (27). These instruments came from different countries, such as French tourniquets and scalpels, English bone-pinchers and German amputation knives.

This instrument-case was symbolic for the reception of the new trends in medicine in Europe by the teachers of the Military Medical Training College. They composed several textbooks for the students written in Dutch in a concise, matter-of-fact way. They avoided sophisticated theories and tried to educate the trainees as universal practical medical officers. In one of their reports the teachers declare :

> The medical officer should excel in his universal practical knowledge. In his person, physician and surgeon should be fully united. Furthermore, he should be his own pharmacist. He is the first man present in the hospital where he is responsable for the care of the sick and the wounded. On campaign, but especially in the navy and out-stations in the East, he has to be an all-round medical man ... (28).

This universal knowledge was taught on a scientific basis. In the book : *Handleiding tot de natuurkunde van den gezonden mensch* (Guide to the Physics of the healthy man),published by F.C. Donders and A.F. Bauduin in 1851, the authors refer to modern research in physiology, published by scientists as Dutrochet, Brücke, Vierordt, Liebig and Lehmann (29).

But besides this practical no-nonsense training, the military aspect of the college also forced the students ("élèves", as they were called) to follow a rigorous training program, with both physical and mental exercises. The pattern of the school was definitely French, like the *Ecole Militaire* at Val de Grâce, with strict schedules and an emphasis on clinical observations and autopsies (30). The examina-

tions were competitive, like the French "concours". Thus the graduates of this college were well-trained, vigorous young men, like Pompe van Meerdervoort, who structured the curriculum of his students in Nagasaki on the same pattern as the Military Medical Training College at Utrecht. He was greatly indebted to Matsumoto Ryojun, a gifted young shogunate physician from Edo (31), who assisted him by being "the medium for communication between Pompe van Meerdervoort and the students" (32). We should realize that Pompe van Meerdervoort had to give all the courses alone, from basic medical science, chemistry, anatomy to clinical teaching. He soon recognized that the students were especially attracted by practical exercises; he introduced a dissection course and also a practice in bandaging. He was succeeded by Bauduin, who introduced the ophtalmoscope in Japan. After Bauduin, more specialized trainees of the Military Medical Training College came to Japan, like Koenraad Wolter Gratama (1831-1888) who taught chemistry and physics at the Medical School in Nagasaki from 1866-1868. After the Meiji Restoration he moved to Osaka, where he got a Laboratory for chemistry at his disposal in 1869 (33). The last pupil, who was contracted for medical teaching was Tjarko Wiebenga Beukema (1838-1925) who taught at Nagasaki, Tokyo and Yokohama from 1871-1888 (34).

The Military Medical Training College at Utrecht was closed down in 1880, after a period of gradual decline, beginning in 1865. An interesting source of medical knowledge for Japan had come to an end.

Conclusion

In this paper, three higlights on the history of Japanese/Dutch medical relations until 1870 were discussed briefly. Another century has passed by, and I am inclined to repeat the poetical words of Genpaku Sugita once more : 'Time flew like a white horse, cantering past a slit in the wall ...' to which I would like to add three or four *centuries* passed all too quickly ! With great respect we remember the Japanese doctors who mastered the Dutch language and became experts in the Dutch Learning, the *Rangakusha.* We also

admire the *exchange of learning* between Japanese interpreters and von Siebold, the outstanding natural scientist. But most of all we should honour Pompe van Meerdervoort, "The unsung hero of the development of Western medicine in Japan" (35) and his successors, who managed to teach their eager pupils the achievements of Western science in sometimes very difficult or nearly impossible circumstances. I would like to finish this paper by quoting Pompe van Meerdervoort once more :

> " How could we compete with the powerful European countries which could afford to send an impressive fleet to Japan while we now and then showed our flag on a small brig or steamer ? We were only able to maintain our influence in Japan because we could assist the Japanese in developing their Empire along the pathway of knowledge, and we should continue to do so: the Dutch naval detachments, the ship-engineering by Mr Hardes (36), the medical teaching. All this should have been supported by the Dutch Government, it would have given us a more influential position than all diplomatic relations together"(37).

The white horse has passed by. The Netherlands are a small part of the coming Europe of 1992. Japan is a dynamic modern country between the other nations around the Pacific. In both countries regular, international medicine is practised and there is an international exchange of learning. Medical research of high quality is done by Japanese scientists, and various innovating techniques have been introduced by Japanese surgeons. The Netherlands are playing their part in the medical world as well, but we could never, as Pompe suggested, continue to transfer knowledge to Japan exclusively on the basis of mutual understanding and tradition. We are growing into one big world. Let us continue to be friends and colleagues, to bring the best of medical knowledge to all nations, especially to those which are in urgent need for medical assistance.

NOTES

1. Jhr. J.L.C. Pompe van Meerdervoort, *Vijf Jaren in Japan (1857-1863). Bijdragen tot de kennis van het Japansche Keizerrijk en zijne bevolking.* Leiden, Firma van den Heuvel en van Santen,

1867. Vol. II, p.161. An English edition of this study was published in 1979 by Sophia University, Tokyo. It was translated and annotated by Elisabeth P. Wittermans and John Z. Bowers.

2. Military Medical Training Center, or Training College for Military Surgeons.

3. A.M. Luyendijk-Elshout, "Anatomia Reformata. The Dutch handbook of anatomy from the bâroque period; the contents and presentation". *Nihon Ishigaku Zasshi* (1974) 20, p.104-91.

4. C.R. Boxer, *Jan Compagnie in Japan (1600-1817).* An essay on the cultural, artistic and scientific influences exercised by the Hollanders in Japan from the seventeenth to the nineteenth century. Oxford University Press, London/New York 1968, p.54. See also : Grant K. Goodman, *Japan : The Dutch Experience.* The Athlone Press, London and Dover, New Hampshire, 1986, p.49-65.

5. Rembert Dodoens' *Cruydt-boek* etc. was printed in Antwerp in 1554. There were many reprints, also one in Leyden in 1618. It is a national herbarium, devoted to species indigenous to the Flemish provinces. Lorenz Heisters treatises on surgery were published and reprinted may times between 1718 and 1769. They were translated from German into Dutch in 1741, as *Heelkundige Onderwijzingen,* by Hendrik Ulhoorn.

6. Pompe van Meerdervoort, "Vijf Jaren ." *o.c.* : Vol.I, p.115.

7. W.J. Boot, "Japanese Studies in the Netherlands". In : *Japanese Studies in Europe.* Directory Series VII, The Japan Foundation, 1985, p.326.

8. F. Vos, "Dutch words in Kimono" : Dutch influences on the Japanese language. In : *Philipp Franz von Siebold, a Contribution to the Study of the Historical Relations between Japan and the Netherlands.* The Netherlands Association for Japanese Studies. Leiden, 1978, p.41-51.

9. Ishida Sumio, "The Age of Rangaku (Dutch Learning) : Medical Education in Japan during the 19th Century". In : *History of Medical Education.* Proceedings of the 6th International Symposium on the Comparative History of Medicine — East and West. Ed. by Teizo Ogawa. The Ianiguchi Foundation, published by Saikon Publ. Co. Ltd. Tokyo, 1983, p.151-179.

10. *Ibidem*, p.155.

11. *Ibidem*, p.156.

12. Probably the Dutch editions. See Achiwa Goro, *Herman Boerhaave 1668-1738. His Life, Thought and Influence upon Japanese medicine in the periòd of Dutch Learning.* Introduction by G.A. Lindeboom, Tokyo, 1969.

13. Joh. de Gorter, *Gezuiverde geneeskonst, of kort onderwijs der meeste inwendige ziekten.* Amsterdam, Isaak Tirian, 1744. This book was especially written as a manual for surgeons at sea or on a military campaign. Common diseases are well described and many recipees are given in the text.

14. A.M. Luyendij-Elshout; "Anatomia Reformata", *o.c.*

15. Genpaku Sugia, *Dawn of Western Science in Japan : Rangaku Kotohajima.* Kokuseido Tokyo, 1969, p.44.

16. Tadashi Yoshida, "Von Siebold as a Station Doctor". In : *Franz Philipp von Siebold, a Contribution to the Study of the Historical Relations between Japan and the Netherlands.* The Netherlands Association for Japanese Studies, 1978, p.29-38.

17. *Ibidem.*

18. W.R. van Gulik, "Von Siebold and his Collection". In : *Franz Philipp von Siebold* etc. (note 16) p.19-28. From the same author : "Brief History of the National Museum of Ethnology. In : Von Siebold and Japan. Catalogue of the exhibition, held in Japan from March 29-July 31, 1988. Tokyo, 1988.

19. See on von Siebold : John Z. Bowers, *Western Medical Pioneers in Feudal Japan.* The Johns Hopkins Press, Baltimore, Maryland, 1970, Chapter IV, p.92-137.

20. Ishida Sumio, "The Age of Rangaku", *o.c.*, p.169.

21. A. Querido, "Dutch Transfer of Knowledge through Deshima. The Role of the Dutch in Japan's Scientific and Technological Development during the Edo Period". *Transactions of the Asiatic Society of Japan.* Third Series, Vol.XVIII, Tokyo, 1983, p.17-37.

22. K.J. van der Korst, *Om lijf en leven.* Health care and medical care in the Netherlands between 1200-1960. Utrecht, Bohn/Scheltema/Hoek, 1988, p.217-218.

23. Matsuki Akitomo, "The most Northern Area of Cholera Prevalence into Ansei Period (1858-1859)". *Nihon Ishigaku Zasshi* (1983) 29 : p.25-35.

24. John Z. Bowers, *When the Twain meet. The Rise of Western Medicine in Japan.* The Johns Hopkins University Press. Baltimore/London, 1980, p.10-26. See also : Masao Soakawa, "Propaganda Bills for Vaccination distributed during the Kaei Period in Japan". *Nihon Ishigaku Zasshi* (1984), 30, p.62-85.

25. Matsuki Akitomo, "A brief history of Jennerian Vaccination in Japan". *Medical History* (1970) 14, p.199-201.

26. G.T. Haneveld, "Het dagelijks leven der studenten. Het klinisch onderwijs". In : *'s Rijkskweekschool voor Militair Geneeskundigen te Utrecht (1822-1865)* ed. D. de Moulin. Amsterdam, Rodopi, 1988, p.67-80.

27. A.G. van Onsenoort, *Beschrijving van den Heelkundigen Veldtoestel.* Gorinchem, 1928, Referred to by W.J. Mulder, "Medical Instrumentation in the Netherlands". Division of Medical History, The Taniguchi Foundation, Osaka, Japan. In print (1989).

28. G.T. Haneveld, "Het dagelijks leven", *o.c.* p.79.

29. F.N. Grousta, "Het preklinisch onderwijs in zijn natuurwetenschappelijke aspecten". In : *'s Rijkskweekschool voor Militair Geneeskundigen te Utrecht* (note 26), p.49-65.

30. A.H.M. Kerkhoff, "De militair-geneeskundige dienst en de medische hervormingen in de negentiende eeuw". In : *'s Rijkskweekschool voor Militaire Geneeskundigen te Utrecht* (note 26), p.3-16.

31. John Z. Bowers, *Western Medical Pioneers in Feudal Japan.* The Johns Hopkins Press, Baltimore, Maryland, 1970. See the chapter on J.L.C. Pompe van Meerdervoort, p.176-201.

32. Querido, "Dutch Transfer..." *o.c.*, p. 31.

33. H. Beukers, L. Blussé, R. Eggink, *Leraar onder de Japanners. Brieven van Dr K.W. Gratama betreffende zijn verblijf in Japan.* Amsterdam, de Bataafse Leeuw, 1987, p.12.

34. D. de Moulin, "Abituriënten van 's Rijkskweekschool voor Militaire Geneeskundigen werkzaam in Japan". In : *'s Rijkskweekschool voor Militaire Geneeskundigen te Utrecht* ... (note 26), p.111-117.

35. John Bower, "Western Medical Pioneers", *o.c.* p.176.

36. Thomas Hardes was an outstanding engineer, who belonged to the second naval detachment. As Pompe remarks : "In three years he turned a swamp into a factory for steam engineering whose development has no equal east of the Cape of Good Hope ... See "Vijf jaren in Japan", *o.c.* Vol. II, p.173.

37. "Vijf Jaren in Japan", *o.c.* Vol. II, p.240.