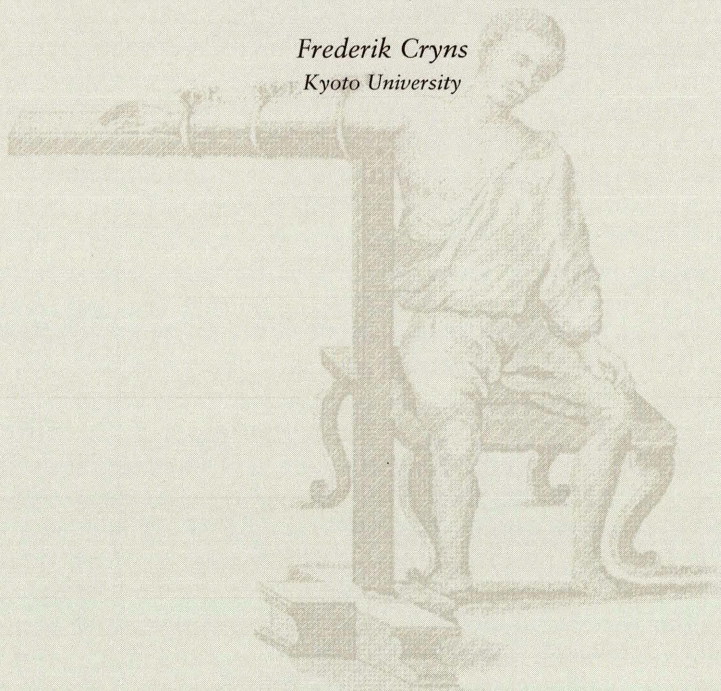


XVI

THE INFLUENCE OF HERMAN
BOERHAAVE'S MECHANICAL
CONCEPT OF THE HUMAN BODY IN
NINETEENTH-CENTURY JAPAN

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INSTITUTIONES
MEDICAE

In usus annuae
EXERCITATIONIS
DOMESTICOS

Digestae ab
HERMANNO BOERHAAVE.
Editio ab eo prima longe melior.



LEODONI REIAYORUM.
Apud **JOHANNEM VAN DER LINDEN**.
M D CCXIII.

I INTRODUCTION

At the beginning of the eighteenth century the Dutch clinician and medical teacher Herman Boerhaave (1668-1738) succeeded in incorporating the various new scientific insights of the seventeenth century and the wisdom of Antiquity into a comprehensive medical system. His ideas exerted a profound influence throughout the whole of Europe. Two of his major works, the *Institutes* (1708)¹ and the *Aphorisms* (1709)² went through re-editions every year until the end of the eighteenth century. Although his system was based on immature science and was superseded by new discoveries in the nineteenth century, Boerhaave's greatest contribution was the foundation of a new scientific approach to medicine, in which empiricism was combined with the introduction of simple mechanical principles to explain all physiological processes in the human body. As can be learned from his *Oration on the Usefulness of the Mechanical Method in Medicine*, Boerhaave saw the human body basically as "composed in such a manner that its united parts are able to produce several motions of very different kinds which derive – fully in accordance with the law of mechanics – from the mass, the shape, and the firmness of the parts and from the way in which they are linked together."³ For Boerhaave the human body was a mechanism, whose working could be fully understood by the science of mechanics. Disease was understood as a condition of the body in which one or more functions were prevented from working. The physician had to be a craftsman "who from his knowledge of the correct structure, discerns the defects of the parts and the ways and means of repairing them".⁴

Boerhaave's doctrines reached Japan through Dutch translations of his Latin works as well as the works of several authors who were

directly or indirectly influenced by Boerhaave's Leyden school, such as de Gorter, van Swieten, Plenck, Huxham, Heister and many others. These works constituted the bulk of medical literature translated by the *Rangakusha*⁵ between 1790 and 1830. However, most of the books imported into Japan were very practical, written as simple textbooks for the practitioner and not for a university audience. They did not contain much about the underlying system of medicine or the author's concept of the human body on which this system was based. His concept was in essence mechanical and alien to Japanese thought. However, in the course of the translation of Western medical works, the *Rangakusha* were at some point or another confronted with this underlying philosophical concept, no matter how poor the availability of explicit information on this subject was. It is indeed very difficult to separate scientific approach from the contemporary philosophical concept of nature. This is especially true in the eighteenth century, when the greater part of the human physiological and pathological system was still based upon speculation.

蘭学者

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This paper endeavours to explore some characteristics of the way *Rangakusha* coped with this basically alien mechanical concept of the human body in Boerhaave's doctrines. For this purpose there are two sources which have to be examined because they are the only two among the Western works that were imported and translated in the Edo period, and that provide explicit information on the theoretical background of Boerhaave's system of medicine. Laurentius Heister's *Practicaal geneeskundig hand-boek* (Practical medical handbook, 1762)⁶ contains a 154 page long dissertation on the mechanical method in medicine. Heister's work was translated by Udagawa Genshin (1769-1834)⁷ as *Heisuteru naikasho* (n.d.).⁸ Another work, Gerard van Swieten's *Verklaaring der korte stellingen van Herman Boerhaave* (Explanation of the maxims of Herman Boerhaave, 1760),⁹ a detailed commentary on the *Aphorisms*, was translated by Udagawa's pupil Tsuboi Shindô (1795-1848)¹⁰ as *Manbyô chijun* (1826).¹¹ Through an analysis of the translation of these two works, I would like to explore how Udagawa and Tsuboi approached Boerhaave's concept of the human body, in particular by focusing on the translation of the term "nature" in relation to the definition of the human body. There are however limitations to this method. It is very difficult to find out what moved the translator in his selection of Japanese equivalents. Yet I hope that a comparative study of the meanings of both the Western and Japanese terms will shed some light on the difficulties the *Rangakusha* encountered when

宇田川玄真

坪井信道

dealing with Western philosophical concepts and what solutions they had to offer.

II UDAGAWA GENSHIN'S TRANSLATION OF THE MECHANICAL METHOD IN MEDICINE

Heister's *Practicaal geneeskundig hand-boek* is the Dutch translation of the original Latin *Compendium medicinae practicae* (Amsterdam: Iansonio-Waesbergios, 1743) and was published by Jan Morterre in Amsterdam in 1762. The handbook proper is preceded by a dissertation entitled *Verhandeling van de voortreffelykheit en uitstekendheit der mechanisch-geneeskundige leerwyze* ('Dissertation on the Excellence and Superiority of the Mechanical-Medical Method'). The dissertation tries to demonstrate through a multitude of examples that the mechanical method is the only right method in the analysis of physiological and pathological processes and in the treatment of diseases. It is conceived as a critique of the Stahlian method. George Ernst Stahl (1660-1734) was a contemporary of Boerhaave and professor of chemistry at the University of Halle in Saxony. He tried to explain life and disease by the action of a "sensitive soul" or "anima" and applied his vitalistic views to the development of psychopathology and therapy. By showing the errors of the Stahlian method and explaining the answers of the mechanical scientists, Heister (1683-1758) tries to demonstrate the superiority of the mechanical method in medicine.

In Heister's dissertation, the fundamentals of the Stahlian doctrine are summarised as follows. The soul and nature of human beings are held to be identical and all medical problems can be reduced to the soul. The soul is the primal force of motion and builds up the body. It co-ordinates all physiological functions and processes and takes care that the body stays healthy. If we would replace the term "soul" by 氣 "vital energy", we may find some resemblance with the notion of *ki* in traditional Chinese medicine. *Ki* is the term that describes the vitalizing substance that circulates through the body together with the blood and sustains the physiological activities of the body. Heister's most important argument for refutation of the Stahlian doctrine is that the soul does not remember anything of her physiological activities. This claim is of course predicated on the premise of a strict separation of matter and mind, resulting in a view of the body as exclusively inanimate. In other words he denies the possibility of the existence of a kind of vitalizing energy without cognition other than the soul. Heister makes a

distinction between the functions of the soul that occur as a result of the will and prior knowledge of the soul, and the functions of nature which have their origin in the structure of the human body, for example the function of the heart and the blood circulation. Still according to the same premise, the existence of such a vitalistic energy is refuted by the fact that the soul has no knowledge or memory of these physiological actions and that these actions cannot be altered by the will of the soul. Heister tries to prove his mechanistic view of the human body by means of an anatomical survey of the heart, the vessels, the stomach and the nervous system. These examples are partly based on Boerhaave's *Institutes*. Heister concludes that the human body is a hydraulic machine. The prime force of action is not assigned to the soul. There is no need for a soul. The human body is a mechanism that imitates and maintains its motion due to its own structure, a sort of *perpetuum mobile*. He uses the metaphor of the watermill. The only thing necessary for the watermill to get in motion is the flow of water. In the same way, the human body only needs the flow of blood.

Heister's *Practicaal geneeskundig hand-boek* was translated by Udagawa Genshin as *Heisuteru naikasho*. The manuscript in the Central Library of Kyoto University (Fujikawa Collection) also includes an abridged translation of Heister's dissertation on the mechanical method in medicine *Verhandeling van de voortreffelykheit en uitstekendheit der mechanisch-geneeskundige leerwyze*, entitled *Jinshin kyûri ijutsu-ron*. Udagawa shows not much interest in the actual debate between the mechanical and Stahlian method so that several parts concerning the critique on the Stahlian method have been omitted. The translation concentrates on the practical examples and the mechanical method as such.

歌伊私の兎内科書

人身究理医術論

Udagawa translates the "functions of the soul" (*werken der ziel*) as *ishiki no sayô*. *Ishiki* is originally a Buddhist term. Contrary to the activities of the five senses, *ishiki* signifies the inner activities of cognition and thinking. In this sense it comes close to Heister's interpretation of the word "soul" as the cognitive agent. It is however quite far away from the original Stahlian meaning of vital energy. It is interesting to note that Udagawa did not choose the term *ki* to translate Stahl's concept of soul. In traditional Chinese medicine there are three qualities that are ascribed to a human being, namely *kei* (form) as the corporeal receptacle, *ki* as the vitalizing substance and *shin* as the mind.¹² The meaning of Stahl's soul, perceived as vital energy, is closer to *ki*, but Udagawa chose *ishiki*, the meaning of which lies in the category

意識ノ作用, 意識

形
神

of *shin*. Had he chosen *ki*, his readers could have construed the debate between Heister and Stahl as a debate between the “Western” mechanical view and the “Oriental” vitalistic view. With the present choice of terminology however, it is hard to make a link between the concept of soul in the Stahlian doctrine and the concept of *ki* in traditional Chinese medicine.

The “functions of nature” (*werkingen der natuur*) are translated as *shizen no sayô*. Udagawa translates “nature” in all cases as *shizen*, regardless of the various nuances in meaning the word has in the original text. Physics (*natuurkunde*) is translated as *shizen-jutsu* and *shizen no gakujutsu*. This is a literal translation, which does not convey the meaning of physics properly. As has been noted in earlier studies, the word *shizen* was only adopted to represent the Western meaning of “the natural world” or “nature as an object of scientific study” in the middle of the Meiji period. In the Edo period most *Rangakusha* used as equivalents for this Western concept words such as *tenchi* (heaven and earth), *banbutsu* (all things), *zôka* or *zôbutsu*. In his translation draft of de Gorter’s *Gezuiverde geneeskunst* (1744), Udagawa Gen-shin’s teacher Udagawa Genzui (1755-1797) uses *shizen* as a translation for “natuur”¹³ in the sentence “Although one does not know how nature functions here” (*Alschoon men niet weet hoe de natuur hier in het werk gaat*),¹⁴ but in the printed version *Seisetsu naika sen’yô* (completed in 1790), the above sentence is translated as *其造物者ノ為ス所其然ル所以ヲ知ルコト能ハズ*, in which the interpretation of “natuur” as *shizen* is replaced by *zôbutsusha*.¹⁵ Originally *Shizen* was only used as adjective or adverb in the meaning in which *onozukara* (naturally, as a matter of course, of its own accord etc.) is presently used. *Shizen* represented therefore not the natural world as an object, but had a more subjective connotation, implying that certain conditions or activities of a being emanated from an internal power. Phenomena originate from internal substances (*ki*) and *shizen* was used to express the spontaneous condition of the workings of these substances.

In the so-called *Edo-Haruma* Dutch-Japanese dictionary *shizen* appears as the first translation of “natuur”, in a list which includes a number of other interpretations such as *seishitsu* (character) or *keijô* (shape, form).¹⁶ The biggest difficulty the *Rangakusha* encountered with the word “natuur” was that it was used in Western works in two or more different meanings. Its more modern meaning was the aggregate of all natural things, i.e. the natural world. It was however also

自然ノ作用、自然

自然術
自然ノ學術天地
万物、造化、造物

宇田川玄隨

西説内科撰要

自ら

性質、形状

used to indicate the qualities by which something is what it is, the qualities within a being, which are the sources of its behaviour. Egbert Buys's *Nieuw en volkomen woordenboek van konsten en wetenschappen* ('New and Complete Dictionary for Arts and Sciences', 1769-1778), a popular reference book among the *Rangakusha*, gives eight different meanings for "natuur".¹⁷ Udagawa however translates "nature" in all cases by *shizen*, regardless of the different meanings in which it is used. By the "functions of nature" Heister specifically means all functions of the human body, which are not controlled by the mind, i.e. the functions we put nowadays in the category of functions under the control of the autonomic nervous system.

The mechanical scientists perceived the body as a mechanism, which initiates and maintains its workings because of its own structure, like a closed circuit. The word "nature" signified this structure of the human body. During the seventeenth century there was a fierce debate about the meaning of "nature" as used by Hippocrates,¹⁸ who allegedly stated that "nature cures diseases". The adherents of the Stahlian doctrine supported the view that "nature" in Hippocrates signified the soul. Heister however clearly states that "nature is not the soul, but the corporeal structure" (*De Natuur is niet de Ziel. De Lichaamlyke Bouw is de Natuur*).¹⁹ Udagawa translates these two sentences as "*shizen to ishiki no kotonaru wo ron[zu]*" (自然ト意識ノ異ナルヲ論[ズ]) and "*jinsin zôritsu no shizen wo ron[zu]*" (人身造立ノ自然ヲ論[ズ]).²⁰ In the first sentence we can easily grasp Heister's meaning of the difference between soul and nature, but in the second sentence *shizen* is not understood as equal to the corporeal structure, but as the condition of the building process (*zôritsu*) of the human body (*jinsin*).

Heister tries to explain his statement that "nature refers to the structure of the body", through the device of an alleged objection by the Stahlians, which he describes as: "If nature were nothing else than the human body, which can exist of no other parts but material ones, then it would be impossible that, in a healthy condition, it would operate and manage everything so well". (*Als de Natuur anders niet dan 't Lichaam was, 't welk uit geene andere dan stoffelyke deelen bestaan kan; zo ware het egter onmogelyk, dat het zelve in den gezonden staat, alles zo wel gepast verrigten en bestieren [...] zoude.*)²¹ The focus of the Stahlian objection is on the fact that, being a completely material thing, the corporeal structure cannot possibly execute immaterial functions such as the operation of its own struc-

ture. Udagawa however translates as follows: 吾輩「スタリアネン」意識ノ説ヲ廢シテヨリ教示スルニ蓋自然ト名クモノハ他ナシ人身中ニ在テ他ノ有形ノ諸具ト異ニシテスベテ平全ノ時ニ於テ諸物ヲ適從協合シ諸事ヲ弁別命令シ.²² Here he misinterprets Heister's alleged objection of the Stahlians that the human body as such cannot exist of other parts than material ones (and that still according to the Stahlians, therefore an immaterial power is necessary to manage everything). Heister uses this objection to indicate that it is indeed possible for the human body to operate without an immaterial energy due to its structure. But Udagawa interprets this objection inversely. In his translation it seems that the Stahlians deny the existence of such energy and that Heister defines *shizen* as something in the human body, which is different from the material properties of the body such as the various organs. Udagawa emphasises this definition by adding an explanatory sentence at the end of the paragraph stating that "*shizen* supervises the transitions of the material and immaterial properties, conveys the phenomenalization of *ri* (the absolute principle of the universe) and is the fundamental source of the innate good capacities and fundamentally good nature, which harmonises all things" (故ニ自然ハ有形無形ヲ主化スル事ヲ主宰ニシテ象理ヲ通知シ諸物ヲ協和スルノ良能性善ノ大本也).²³ Udagawa uses *shizen* here as a noun and attributes to it the role of managing the properties of the human body. The term "phenomenalization of *ri*" shows some resemblances with the Neo-Confucian metaphysics of Zhu Xi. All things were thought to have their respective *ri* or fundamental principle and their *ki*, a kind of substance which creates forms. Heister means however the opposite, namely that the body is created in such a way that it can function and cure defects in its structure (diseases) to some extent independently without the help of an immaterial power.

朱熹
理
氣

Heister makes this clear in the following words: "all changes occurring in the human body are being produced by the motion and the composition of its parts" (dat alle veranderingen, in het mensche-lyke lichaam voorvallende, door de Beweeging en de t'zamenstelling der Deelen voortgebracht worden) and further "it being very wisely arranged by the Creator in such a way that every part may retain the powers and capacities that have been allotted to it, according to the proportions and properties of its essence. From this then originate all operations and changes in this body, not by the order of the soul, nor in accordance with the direction of the soul, but due to a certain mechanical necessity." (Zynde het door den Schepper zeer wyslyk also

geschikt, op dat ieder deel zyne bepaalde, hem toegelegde krachten en vermogens, naar evenredigheid en hoedanigheid van zyn weezen [...] behouden mogt. Hieruit ontstaan nu alle in 't zelve lichaam voortgaande verrigtingen en veranderingen, niet op het bevel, of volgens het bestier der ziele; maar door een zekere mechanische noodzakelykheit).²⁴ Udagawa translates the first part as follows: 故二人身諸般ノ変化スル諸具ノ輻輳造成シ運動ヲナス. This translation reveals that several parts (or tools) change several parts of the human body and that they congest, create and move, but not that the changes occurring in the human body are innate to the structure of the body. The second part, which is the key point of Heister's thesis, is translated as follows: 然レドモ造物者神通不測ノ妙用ヲ以テ製作シ又諸部順列配置ハ外ヨリ形象ニ因テ察ストイヘドモ其造成スルノ精力順整ニ流利快行シ開闢ノ機発スル事皆其天性自然ノ良能ヨリ発原スル事ヲ探索スベキ也.²⁵ Again, the idea of mechanical necessity is not reproduced faithfully. Moreover, Udagawa introduces the concept of *seiryoku*, one of the creative substances (*ki*) in traditional Chinese medicine, to explain the changes occurring in the body, while Heister precisely tries to prove that these changes are not produced by any kind of energy. Udagawa's interpretation ends up to be exactly the opposite of the original text.

精力

Udagawa's translation does not reveal clearly Heister's thesis that all motions originate from the structure of the body. This is most clearly displayed in the passages where he translates "a certain mechanical necessity" by "everything originates from these innate, "natural" capacities" (皆其天性自然ノ良能ヨリシテ発原スル事). Here again Heister's concept of the human body as an inanimate mechanism is replaced by the concept of an animated organism, driven by innate energies. This replacement is quite obvious, as seen in the light of the fact that European scientists were used to the sight of machines, such as clocks etc., in their daily life, whereas this was not the case in Japan. Natural philosophy, as it was developed by Newton, concentrated its efforts on the mathematical and mechanical explanation of the natural world. The European physicians had a grounding in this kind of mathematical knowledge, which they tried to apply to their own scientific field, whereas the Japanese physicians received a Confucian, philosophical education with no notion of mathematical concepts. Udagawa was not an exception, and so he tried to comprehend Heister's mechanical concepts within his own intellectual framework.

In some cases however, when the definition of the human body is

expressed in clearer terms, Udagawa's translation comes closer to the meaning of the original. This is the case in the following example: "The structure and composition of our body is prepared by the Creator in no other way than as an ingenious hydraulic machine, or a clock" (dat de bouw en opstel van ons Lichaam anders niet, dan als eene konstige hydraulicque Machine of Water-werktuig, of als een uurwerk [...] door den Schepper toebereid is).²⁶ Udagawa stays close to the metaphor of the human body as machine by translating this sentence as: 人身ノ基礎構立スルモノハ他ナシ奇巧絶妙ナル運水ノ器自鳴鐘ノ如ク...真ニ造物者ノ製作感ズルニ勝ヘタリ.²⁷ Note the translation of "Creator" as *zôbut-susha*. The reference to the "Creator of our mechanism" is not limited to Heister, but appears in almost all medical works of the period. Udagawa translates the term "Schepper" (Creator) in most cases as *zôbut-sushu* or *zôbutsusha* and the term "schepping" (creation) as *zôbutsu*. The term appears in the writings of other *Rangakusha* too. *Zôbutsushu* was the same term employed by some Jesuits in China to represent the Creator in their Chinese writings. Giulio Aleni (1582-1649) used the term in his *Zhifang waiji*, a work with a widespread circulation among the *Rangakusha*. The adoption of this term however does not imply that the *Rangakusha* understood its implications in a Western sense. The more common term used by the Jesuits and known to the *Rangakusha* to denote the Christian God specifically was *tenshu*. *Zôbutsu* is originally a Confucian term. It was used to refer to the earthly forms, which were created by the innate creative substance *ki*. The fundamental difference with the Christian notion is that these *zôbutsu* are conceived of as coming into existence due to an energy from within and not as an object created by a creator outside. When employing the term *zôbutsu*, the *Rangakusha* did not by the same token adopt the western view of nature as an object, functioning as a machine, put together and set in motion by the Creator as a craftsman would do, but used the terminology of their own philosophical system. As this term was regularly used in Confucian texts, its use did not arrest the attention of the reader.

造物者

造物主、造物者
造物

職方外紀

天主

人身固形ノ諸部
流動血液
人身中の器械各自己ノ主能一箇
ノ作用アリテ

Heister's definitions of the solids (*vaste deelen*) and fluids (*vloeibare deelen*) are faithfully translated. The solids are defined as either vessels, through which the fluids flow, or certain machines. Udagawa's translation comes quite close to the idea of mechanical necessity when he writes that every part has its own function and that these parts work together in sequence and form a unit to produce certain functions (相共ニ列次連属シテ又一物ト成テ一箇ノ作用ヲ為ス).²⁸ That the fluids work

“according to the hydraulic or mechanical laws” (en dit alles wel op het naauwkeurigste volgens de wetten der Water-konstwerken [...] en naar het voorschrift der Mechanica)²⁹ is also quite correctly translated as 運水術及諸具巧術ノ法ニ從テ理合シ [...],³⁰ but when he adds that we have to perceive the working of the “natural” truth 自然真実ノ作用ヲ悟ベシ, Udagawa again curbs Heister's theories into his own intellectual framework.

We may therefore conclude that the mechanical concept of the human body is not represented clearly in Udagawa's translation, although the translation itself is quite literally. By reading only the translation without knowledge of the original text, it would have been difficult for his contemporaries to gain a clear notion of the theoretical foundations of the scientific approach of the European physicians towards the human body. The work is however important because there are sufficient indications that the theoretical concept on which the Dutch imported medical books were founded, was totally different from the Japanese traditional views. The fact that Boerhaave's name is mentioned several times in relation to the mechanical method, has perhaps contributed to the fact that Udagawa urged his pupil Tsuboi Shindô to start his translation of Boerhaave's *Aphorisms*.

III TSUBOI SHINDÔ'S INTRODUCTION OF BOERHAAVIAN PHYSIOLOGICAL THEORIES

Heister's dissertation is the only work translated in the Edo period that provides such extensive information on the theoretical background of Boerhaave's theories. The *Rangakusha* Shingû Ryôtei (1787-1854) owned a copy of the Dutch version by Lové of the *Institutes*, Boerhaave's primary work in which his theories on the physiology of the human body are explained in detail, but no Japanese translation of this work has been found yet. The only work of Boerhaave that has been translated in the Edo period, was the *Aphorisms*. The work on which Tsuboi's translation is based, is *Verklaaring der Korte Stellingen van Herman Boerhaave over de Kennis en Geneezing der Ziektens* (Leyden: Joh. en Herm. Verbeek, 1763-1776), the Dutch translation of van Swieten's (1700-1772) *Commentaria in Boerhaave Aphorismos de Cognoscendibus et Curandis Morbis*. The *Aphorisms* is a general work on pathology and therapy. It consists of 1479 aphorisms, or short statements concerning practical medicine. Van Swieten's work is a commentary on each of these aphorisms, giving detailed explanations, numer-

ous quotations from classic and contemporary medical literature and many clinical examples. Van Swieten based the commentaries on his lecture notes of Boerhaave's classes. We can assume that they capture the essence of Boerhaave's doctrines relatively faithfully. No detailed theoretical explanations of Boerhaave's mechanical concept of the human body can be found in van Swieten's commentary. The principles of mechanics have however a pervasive influence throughout the whole work in the many practical physiological and pathological examples it offers.

蒲爾花歌萬病治準

蒲爾花歌內病論
萬病治準

Tsuboi Shindô translated a considerable part of van Swieten's commentary between 1823-26. The first part of his translation, *Buruhabe manbyô chijun* covers chapters 1 to 169, containing the introductory notes and general pathological explanation of the diseases of the fibres, the vessels, viscera and fluids. The second part, a translation of chapters 558 to 718, entitled *Buruhabe naibyô-ron*, concerns the febrile diseases. Both works are commonly referred to as *Manbyô chijun*. With this selection Tsuboi covers Boerhaave's general doctrines on internal diseases. The chapters 145 to 557, out of which Tsuboi translated only chapters 145-169, deal with surgery. The chapters following 718 deal with special pathology. Boerhaave's aphorisms are translated in classical Chinese, the commentaries of van Swieten in Japanese.

I would like to focus my analysis on some passages in this translation, which have an indirect link to the mechanical concept of the human body. Boerhaave defines disease as "all conditions of the human body, which prevent the vital, natural or animal functions." (Alle gesteldheid van het menschelijk lighaam, die de levendige, natuurlijke, of dierlijke werkingen verhindert, wordt Ziekte genoemd).³¹ This sentence implies that Boerhaave had a functional view of health and disease. Proper working of these functions is called health, while disease is a condition in which these functions are impeded. Tsuboi translates as follows: 人身ノ三機ヲ活機、性機、神機ト謂フ。一モ妨碍セ被ルル所有ル、是レヲ疾病ト謂フ。³² As the word *ki* means working or mechanism (*karakuri*), the translation stays very close to the original. This sentence in itself is however not enough to comprehend the human body as mechanical. At first sight, these functions can equally be interpreted as vitalistic. A more detailed analysis of the translation of the definition of the three functions is therefore necessary.

The "vital and natural functions" are, in accordance with Heister's

definition, the functions that are not controlled by the soul. In his explanation about the vital functions, van Swieten only gives a tautological definition in the beginning. He defines vital functions as all functions without which there can be no life. In an example he refers to the phenomenon of drowning, observing that “only movement is lacking, if you can resuscitate it, life also returns” (de beweeging alleen ontbreekt, en kunt gy die weer opwekken, dan komt het leven ook weer).³³ Tsuboi does not translate this sentence literally, but interprets “movement” correctly as the blood circulation: “only the blood circulation is interrupted” (唯々血ノ運行休止スルノミナリ).³⁴ After this he gives his own interpretation of vital functions (*kakki*) as “one has to know that the vital functions are to be found in the blood circulation” (故ニ活機ハ血ノ運行ニ在リト知ルベシ). By this definition, Tsuboi displays a remarkable understanding of the mechanical theory. “Beweeging” is the translation of “motus” in the Latin edition of van Swieten’s Commentaries.³⁵ The term “motus sanguinis” is used by William Harvey (1578-1657)³⁶ and Richard Lower (1631-1690)³⁷ to designate the circulation of the blood. The influence of these two anatomists is apparent throughout the *Aphorisms*. For Boerhaave the basic mechanism of life was the circulation of the blood. The heart was the motive power of this mechanism. Van Swieten writes that “there is still life however weak, as long as the heart opens and closes” (dat het minste leven nog bestaat in de werking van het gesloten en geopend hart),³⁸ which Tsuboi translates correctly as “it is evident that the primary existence of life is based on the circulation of the blood. The source of the circulation of the blood is the movement of the heart” (生命ノ存ズル事一二血ノ運行ニ由ル事昭昭タリ血ノ運行ノ起源ハ心ノ運動ニ在リ).³⁹

活機

The working of the blood circulation is viewed as a closed circuit with no beginning and no end. Here van Swieten faces the same difficulty as Heister, namely the ultimate origin of this movement. Heister tries to explain this by means of the concept of a *perpetuum mobile*. It was however known that the heart still continues its movement for some time, even without the help of the other parts of the human body. The existence of the autonomic nerve had not yet been discovered. Van Swieten therefore quotes the words of Galen: “movement is created into the heart” (Galenos heeft gezegd, dat de beweeging het hart is ingeschapen).⁴⁰ In other words he attributes this as yet inconceivable part of the human mechanism to the work of the Almighty Creator. Tsuboi translates as follows: 運動ハ心臓ノ稟受スル所ナリ.⁴¹ The term *hinju* 稟受 employed for “ingeschapen” (created into) literally means “to receive

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from heaven” and is in this sense a correct translation. *Hinju* is however a purely Confucian term, which in my narrow view was not used by the Jesuits in China. It did not imply the existence of a Creator outside the human body but was only used in the meaning of “innate characteristics”. Tsuboi consistently avoids terms used by the Jesuits and adopts Confucian terms to designate Western religious concepts. This stands in contrast to Udagawa’s automatic use of *zôbutsushu*.

The second category of functions, which are not ruled by the soul, are the natural functions (*natuurlijke werkingen*). These are the digestive functions or as van Swieten states: “all those functions that provide the human body with such things as it has lost (= nutrition)”.⁴² The digestive system is an important pillar in Boerhaave’s medical system. It was believed that the absorbed food was gradually converted in the digestive tract, including the vessels, the lungs and the blood itself. A good digestion depended on the action of the solids and the aid of some fluids. Although some chemical characteristics were attributed to it, the digestive system was mainly conceived of as a mechanical system. Van Swieten calls the digestive functions of the human body the “nature” of the human body. Here nature is used in the same meaning as Heister used it and it is a keyword to understand Boerhaave’s mechanical concept of the human body. In *Manbyô chijun* we can see clearly that Tsuboi had difficulties finding a suitable translation for the term “nature”. The food we take in, writes van Swieten, is not of the same substance as the human body. In order to build the parts of the human body, which are lost due to the working of the vital functions, “nature needed to change those things (i.e. food and drink) first and to boil them and to prepare them in advance to a certain equality with the human body, that has to be nourished” (*hierom heeft de natuur nodig gehad die dingen eerst te veranderen, en te koken, en vooraf tot eene gelijkheid met het lighaam, dat gevoed moet worden, te bereiden*).⁴³ Tsuboi translates the term “nature” as it is used in this sentence by *shizen no ryônô*. *Shizen no ryônô* may tentatively be translated as “natural capacities”. To clarify his statement, van Swieten repeats the above sentence but replaces the term “nature” by a more detailed definition: “the most complete tool of the created body is required to make nourishment from it (i.e. the ingested food)” (*het volkomenste werktuig van het geschapen lighaam wordt vereischt, om daar uit voedsel te maken*).⁴⁴ Tsuboi translates this sentence as 体中諸器ノ機能健康ニシテ.⁴⁵ Although *Edo-Haruma* and *Zufu-Haruma* respectively give 器械 and 細工道具 (both meaning “tool”) as translation for “werktuig”, Tsuboi

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interprets this word here correctly as “the various organs of the human body” and does not make any reference to the mechanical terminology.

To explain his use of the term “nature” van Swieten cites Hippocrates: if the digestive powers are insufficient, “nature itself is insufficient” (dat de natuur zelve te kort schiet: translated by Tsuboi as 良能衰弱スルノ徴ナレバナリ).⁴⁸ Note again the use of *ryōnō*). Van Swieten defines this notion of nature as used by Hippocrates as “a convergence of all natural conditions, which are required for life to be continuous and durable and at the same time a very fast movement” (eene samenloop van alle natuurlijke gesteldheden, die vereischt worden, op dat het leven bestendig en duurzaam, en te gelijk eene zeer vlugge beweging zy).⁴⁹ This is an abstract definition, from which it is difficult, especially for a *Rangakusha*, with his different intellectual background, to interpret the natural conditions as the corporeal mechanism. Tsuboi understood in any case that the term *shizen* was not appropriate. He first uses the transliteration *nachûru*. But he adds a note that the term *nachûru* can be interpreted as *honzen* and natural functions as *honzen no kinô* (本然トハ本然ノ機能ノ義ナリ).⁵⁰ *Honzen no sei* is a term used in the metaphysics of Zhu Xi to represent the pure innate properties of the human body. Its meaning stands closer to van Swieten’s “nature” than Udagawa’s *shizen*, but because of its Confucian philosophical connotations does not cover completely the concept of the body as an inanimate mechanism.

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Van Swieten’s above-mentioned definition Tsuboi translates as follows: “When using this word [i.e. *nachûru*] people refer to the functions which assure that the various organs and humours have all their innate properties so that they can maintain the vital energy and make fast and light movements” (此語ヲ用フル者ハ人身諸器諸液共二本然ノ稟質ヲ具有シテ能ク生氣ヲ保持シ又能ク運動ヲシテ輕敏ナラシムル所ノ機能ヲ言フ).⁵¹ Tsuboi uses here Confucian vitalistic terms such as *honzen no hinshitsu* and *seiki*, which are incompatible with the mechanical ideas of the original. Tsuboi’s use of these Confucian terms probably has its origins in the vagueness of the Dutch edition. In the Dutch edition “natuur” is tautologically defined as “alle natuurlijke gesteldheden”, whereas in the original Latin edition, “Natura” is defined as “aggregatum omnium conditionum physicarum” (“the aggregate of all physical conditions”).

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In the following sentences where van Swieten further explains his

definition of “nature” by means of some examples, Tsuboi is still struggling with the interpretation of this term. Van Swieten writes: “The physicians do no injustice to the Supreme Being, when they attribute so much to Nature, because by this [i.e. Nature] they mean the structure of the created body” (De Geneesmeesters doen dan het Opperwezen geen ongelijk, wanneer zy zo veel aan de Natuur toeschryven; want door deeze verstaan zy het maaksel van het geschapen lighaam).⁵² Tsuboi apparently did not understand this sentence and gave his own interpretation: “If the physicians would not use their own knowledge and would leave everything to nature, they would acquire with other words divine knowledge. When following nature it however is possible for them to acquire the fundamental knowledge of the heaven-made human body” (医者若シ能ク私知ヲ用ヒズシテニ那去兒ニ委任スル時ハ則チ神知ニ等シキ事ヲ得那去兒ニ従フ時ハ人身天造ノ原質知了スル事ヲ得可ケレバナリ).⁵³ It seems that Tsuboi interpreted the word “verstaan” as “to understand” and not as “to mean”, in which meaning it was used in the original sentence. Due to this misinterpretation, Tsuboi did not correctly translate the sentence that “by nature they mean the structure of the created body”. As stated above, there was a debate in the seventeenth century concerning the interpretation of Hippocrates’ statement that “nature cures diseases”. In the above sentence, van Swieten interprets this “nature” of Hippocrates as the structure of the human body. By the words “to follow nature” as a translation for “to attribute to nature” (aan de natuur toeschrijven), Tsuboi composes a popular concept in the Edo period that the physician had to be the servant of nature. This concept was attributed by *the Rangakusha* to Hippocrates. Tsuboi was one of the admirers of Hippocrates and wrote some Chinese poems in praise of him. It seems that for lack of understanding of the above sentence, Tsuboi fell back on this concept.

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Van Swieten continues his explanation by citing van Helmont:⁵⁴ “Van Helmont has therefore said very rightly that Nature is an order from God, by which the things are what they are and work as they are ordered to work” (Helmont heeft dan ook zeer wel gezegd, dat de Natuur is een bevel van God, waar door de dingen zyn het geenze zyn, en werken, het geen haar bevolen is te werken).⁵⁵ Tsuboi translates as follows: “Helmont has said that nature is an order from the creative process (*zôka*). The things peculiar to the human body all originate from the creative process and all their functions are what they are because the creative process makes them to be like that.” (「ヘルモント」云ク那去兒ハ造化ノ使令ナリ人身固有ノ諸物ハ共ニ造化ニ由テ生ズル所ニシテ其官能ハ造化ノ指揮シテ然カラシムル所ナリ).⁵⁶ I have trans-

lated *zôka* not by “Creator”, but by “creative process”, which is in my opinion closer to the original meaning of this term. *Zôka* was used by many *Rangakusha* to translate the terms “nature” and “Creator”, but it does not completely cover the Western meaning implied in the terms. *Zôka* was used in Confucian texts to represent the creative process of Yin and Yang, the cosmic dual forces. By using *zôka* for Creator, Tsuboi again avoids the religious aspect in this statement and replaces it by Confucian terminology. Tsuboi uses the phonetic substitute *nach-ûru* only in the paragraph concerning the natural functions. The natural functions he first translates as *honki* (the fundamental functions), but later he switches to *seiki* (the innate functions). Throughout the text Tsuboi does not restrict the translation of “nature” to one term but uses mainly *honzen* to representing innate qualities and *shizen no ryônô* in the Hippocratic meaning of nature healing. The animal functions (dierlijke werkingen) are defined as all cognitive functions in the human body that are governed by the soul. Tsuboi first translates the animal functions as *konki*, a term used in traditional Chinese medicine to represent the positive *vitalising* energy which governs the mind, but he afterwards corrects *konki* in *shinki*. *Shin* was, as indicated above, the name for the category of the mind, which means that Tsuboi's translation is quite appropriate.

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IV CONCLUSION

Through the analysis of the translations of Heister's and van Swieten's work by Udagawa and Tsuboi, I have tried to show that these *rangakusha* had many difficulties in overcoming the cultural and linguistic barrier and gaining an understanding of Boerhaave's mechanical concept of the human body. A literal translation, such as the one Udagawa made, was apparently not sufficient to reach a profound understanding, because the traditional Japanese terms were used in a totally different context. Udagawa's translation comes in some cases to opposite conclusions regarding the “natuur” of the human body. We have seen that Udagawa had to fall back on traditional Chinese vitalistic concepts to explain the functions of the body, in contrast to Heister's statement that the structure of the human body itself is the origin of its functions and that these functions work as an inanimate mechanism. Tsuboi grasped the mechanical concept better as is apparent for example in his translation of the blood circulation. Contrary to Udagawa, who translates the word “natuur” in all cases by *shizen*, Tsuboi tried to use different terms to represent the different meanings the word

“nature” had. His interpretations are but for a few exceptions correct, which indicates that he had a good understanding of Boerhaave’s theories. However, regarding the ideological connotations of the original terms, it cannot be said that he translated them word for word with the same accuracy. Tsuboi often gives a free translation for purely mechanical terms. For the term “natuur”, when it is used with mechanical connotations, he first uses a transliteration and later on *honzen*, a Confucian term. Christian terminology such as “Creator” he omits or expresses by abstract terms such as *zōka*. From these examples we may conclude that Tsuboi, although he had a good understanding of Boerhaave’s mechanical concept, excluded purely mechanical and religious concepts, or transformed them into terms that fitted his own intellectual framework. It is indeed quite difficult to read the mechanical concept of the original explicitly in Tsuboi’s translation.

NOTES

Sentences in classical Chinese are transposed in kakikudashibun 書下文.

- 1 Herman Boerhaave, *Institutiones medicae: in usus annuae exercitationis domesticos digestae* (Lugduni Batavorum: van der Linden, 1708).
- 2 Herman Boerhaave, *Aphorismi de cognoscendis et curandis morbis in usum doctrinae domesticae* (Lugduni Batavorum: van der Linden, 1709).
- 3 E. Kegel-Brinkgreve and A.M. Luyendijk-Elshout, trans., *Boerhaave’s Orations*, Publications of the Sir Thomas Browne Institute, n.s., no. 4, with introduction and notes by E. Kegel-Brinkgreve and A.M. Luyendijk-Elshout (Leiden: Brill, 1983), 96.
- 4 Kegel-Brinkgreve and Luyendijk-Elshout, *Boerhaave’s Orations*, 111.
- 5 Rangakusha 蘭学者: a scholar in the Edo period who studied Western sciences by means of the Dutch language.
- 6 Laurentius Heister, *Practicaal geneeskundig handboek; nevens een voorafgaande verhandeling van de voortreffelykheit en uitstekendheit der mechanisch-geneeskundige leerwyze* (Amsterdam: Jan Morterre, 1762).
- 7 Udagawa Genshin 宇田川玄真 (1769-1834): native of Ise; went to Edo to study under Udagawa Genzui 宇田川玄隨, Ōtsuki Gentaku 大槻玄沢, Katsuragawa Hoshū 桂川甫周 and Sugita Genpaku 杉田玄白; succeeded the Udagawa family after Genzui’s death.
- 8 Udagawa Genshin, trans., *Heisuteru naikasbo* 「歌伊私的兒内科書」, appended: *Jinshin kyūri ijutsuron* 「人身究理医術論」 (unpublished manuscript, Edo, n.d.). For my analysis I have consulted the manuscript of the Central Library of Kyoto University (Fujikawa Collection).
- 9 Gerard van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave: over de kennis en geneezing der ziekten*, 4 vols. (Leyden: Verbeek, 1760).
- 10 Tsuboi Shindō 坪井信道 (1795-1848): native of Mino. After learning Chinese Medicine, Tsuboi studied *Rangaku* under Nakai Kotaku and Udagawa Genshin.
- 11 Tsuboi Shindō, trans., *Burubabe manbyō-chijun* 「蒲爾花歌萬病治準」 (covering the original chapters 1-169); *Burubabe naibyō-ron* 蒲爾花歌內病論 (covering the original chapters 558-718), trans. (unpublished manuscript, Edo, 1826). I have consulted the manuscript of the Kyō-u Library of the Takeda Science Foundation in Osaka (Udagawa Collection). Both works are hereafter cited as *Manbyō-chijun*.
- 12 Liu An 劉安, ed., *Enanji* 「淮南子」, *Chūgoku koten bungaku taikei* (「中国古典文学大系」, Series of Chinese Classical Literature), vol. 6, trans. Togawa Yoshio 戸川芳郎, Kiyama Hideo 木山英雄 and Sawatani Shōji 沢谷昭次 (Tokyo: Heibonsha, 1974), 12, 「形体は生の宅舎、気志は生の内実、精神は生

- の主宰」。Originally published as Huainanzi.
- 13 Udagawa Genzui's handwritten copy of de Gorter's book and his translation notes for *Seisetsu naika sen'yō* can be found in the Kyō-u Library of the Takeda Science Foundation in Osaka (Udagawa Collection), under the title *Uda-shi Hikyū* 「宇多氏秘笈」 (Udagawa's secret wicker box), fasc. 2-8.
- 14 Johannes de Gorter, *Gezuiverde geneeskunst, of kort onderwys der meeste inwendige ziekten, ten nutte van chirurgyens* (Amsterdam: Isaac Tirion, 1744), 31-32.
- 15 Udagawa Genzui, *Seisetsu naika sen'yō* 「西説内科撰要」 (Edo, completed 1790, published 1791-1808). I have consulted the facsimile edition of Waseda University Library (Tokyo: Waseda Univ. Press, 1995).
- 16 Edo-Haruma Dutch-Japanese Dictionary. I have consulted *Haruma-shi Oranda jisho* 「波兒馬氏和蘭辭書」, a manuscript copy ascribed to Takano Chōei and kept in the Kyō-u Library of the Takeda Science Foundation in Osaka (Udagawa Collection). This dictionary lists following equivalents for “natuur”: 自然、神力ニテ造ル、造化ノ神、性質、形状、自然ノ理、欲シ好ム、自然ノ好欲、損ズル、枯ルル。
- 17 Egbert Buys, *Nieuw en volkomen woordenboek van kosten en weetenschappen* (Amsterdam: S.J Baalde, 1769-1778. 10 vols.), vol.VII, 627-628.
- 18 Hippocrates is frequently cited as an authority by Heister and his contemporaries. The high value Boerhaave attributed to Hippocrates in the clinical field, can be derived from his *Oratio to Recommend the Study of Hippocrates (Oratio de Commendando Studio Hippocratico, 1701)*.
- 19 Heister, *Verhandeling van de Voortreffelykheit en Uitstekendheit der Mechanisch-Geneeskundige Leerwyze*, 101-103.
- 20 Udagawa, *Jinshin kyūri ijutsu-ron*, chap. 38-39.
- 21 Heister, *Verhandeling van de Voortreffelykheit en Uitstekendheit der Mechanisch-Geneeskundige Leerwyze*, 106.
- 22 Udagawa, *Jinshin kyūri ijutsu-ron*, chap. 40.
- 23 Ibid.
- 24 Heister, *Verhandeling van de Voortreffelykheit en Uitstekendheit der Mechanisch-Geneeskundige Leerwyze*, 109-110.
- 25 Udagawa, *Jinshin kyūri ijutsu-ron*, chap. 41.
- 26 Heister, *Verhandeling van de Voortreffelykheit en Uitstekendheit der Mechanisch-Geneeskundige Leerwyze*, 106.
- 27 Udagawa, *Jinshin kyūri ijutsu-ron*, chap. 9.
- 28 Ibid., chap. 10.
- 29 Heister, *Verhandeling van de Voortreffelykheit en Uitstekendheit der Mechanisch-Geneeskundige Leerwyze*, 29.
- 30 Udagawa, *Jinshin kyūri ijutsu-ron*, chap. 11.
- 31 Van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave*, deel 1, 1.
- 32 Tsuboi, *Manbyō-chijun*, chap. 1, fol.1.
- 33 Van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave*, deel 1, 2.
- 34 Tsuboi, *Manbyō-chijun*, chap. 1, fol.2.
- 35 Gerardi van Swieten, *Commentaria in Hermanni Boerhaave aphorismos de cognoscendis et curandis morbis* (Lugduni Batavorum: Johannem et Hermannum Verbeek, 1742-1772. 5 vols.), vol.1, 2.
- 36 William Harvey, *Exercitatio de motu cordis et sanguinis in animalibus* (Francofurti: Guilielmi Fitzeri, 1628).
- 37 Richard Lower, *Tractatus de corde. Item de motu & colore sanguinis et chyli in eum transitu* (Londini: John Redmayne, 1669).
- 38 Van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave*, deel 1, 2-3.
- 39 Tsuboi, *Manbyō-chijun*, chap. 1, fol.3.
- 40 Van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave*, deel 1, 4.
- 41 Tsuboi, *Manbyō-chijun*, chap. 1, fol.5.
- 42 Van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave*, deel 1, 5.
- 43 Ibid.
- 44 Ibid.
- 45 Tsuboi, *Manbyō-chijun*, chap. 1, fol.7.
- 46 vid. note 16.
- 47 Hendrik Doeff's Dutch-Japanese Dictionary popularly known as *Zufu-Haruma*. I have consulted a manuscript copy ascribed to Tsuboi in Waseda University Library.
- 48 Tsuboi, *Manbyō-chijun*, chap. 1, fol.8.
- 49 Van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave*, deel 1, 6.

50 Tsuboi, *Manbyô-chijun*, chap. 1, fol.8.

51 Ibid.

52 Van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave*, deel 1, 6.

53 Tsuboi, *Manbyô-chijun*, chap. 1, fol.8.

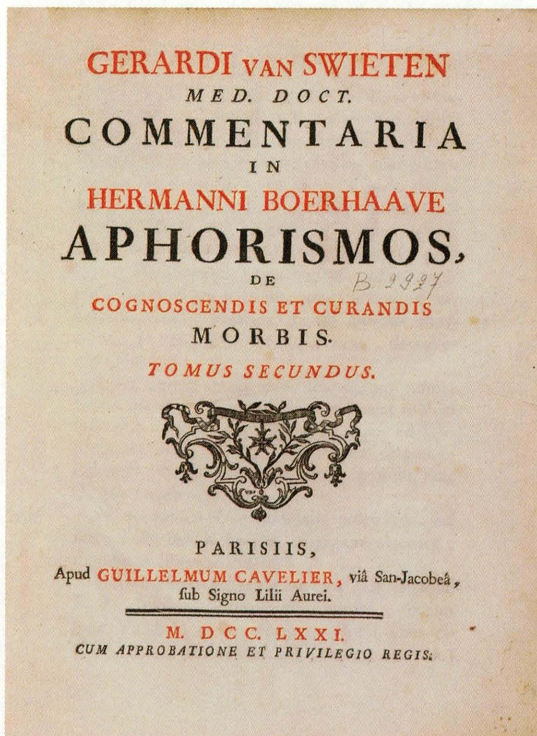
54 Van Helmont (1577-1644) was one of the pioneers of the chemiatic method in medicine. He tried to explain digestion as a series of fermentations. Although Boerhaave had more mechanistic views regarding the digestion system, van Helmont is frequently cited in van Swieten's commentary.

55 Van Swieten, *Verklaaring der korte stellingen van Herman Boerhaave*, deel 1, 6.

56 Tsuboi, *Manbyô-chijun*, chap. 1, fol.9.

ILLUSTRATIONS

- ILL 1 Gerard van Swieten, *Commentaria in Hermanni Boerhaave Aphorismos, de cognoscendis et curandis morbis*. Tomus secundus, Parisiis, Apud Guillelmum Cavelier, MDCCLXXI.
- ILL 2 Joannes de Gorter, *Gezuiverde Geneeskunst, of kort onderwijs der meeste inwendige ziekten, ten nutte van chirurgyns, Die ter Zee of Velde dienende, of in andere omstandigheden, zig genoodzaakt vinden dusdanige Ziekten te behandelen*, derde druk, merkelyk vermeerderd, Te Amsterdam, By Isaak Tirion, MDCCLXI.
- ILL 3 *Institutiones medicae in usus annuae exercitationis domesticos Digestae ab Hermanno Boerhaave*, Edicio altera, Lugduni Batavorum, Apud Johannem vander Linden, MDCCXIII.



ILL 1

GEZUIVERDE
GENEESKONST,
OF
KORT ONDERWYS
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TEN NUTTE VAN
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Die ter Zee of Velde dienende, of in andere om-
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danige Ziekten te behandelen.

DOOR
JOANNES DE GORTER,

Medicinæ Doct̃or en Professor.

Derde Druk, merkelyk vermeerderd.

A49193



TE AMSTERDAM,

By **ISAAKTIRION,**

vooraan in de Kalverstraat, in Huco Grootz.

MDCCLXI.

ILL 2

INSTITUTIONES
MEDICAE

In usum annuae

EXERCITATIONIS

DOMESTICOS

Digestae ab

HERMANNO BOERHAAVE.

Editio altera primâ longè auctior.



LUGDUNI BATAVORUM,

Apud **JOHANNEM VANDER LINDEN.**

MDCCLXIII.

ILL 3