Hermann Boerhaave: A Historiographical Survey

The assessment of the position of Hermann Boerhaave
in the eighteenth century medicine*

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Introduction

Hermann Boerhaave(1668-1738) was probably the most influential and famous person in the European medical world of the eighteenth century. He was born on 31 December 1668, near Leyden. After studying theology and medicine, he taught at Leyden for thirty-seven years, from 1701 until his death in 1738. In 1701, he was appointed lecturer in the institutes of medicine(1701-1709). In 1709, he was appointed professor of both medicine and botany. In 1718, he received a third appointment to the chair of chemistry. In 1729 he resigned the chairs of chemistry and of botany, but he remained professor of medicine until he died. He also delivered clinical lectures at Saint Caecilia Hospital in Leyden from 1714 until 1738.

William Cullen, one of main medical theorists in the late eighteenth century, described the enormous influence of Boerhaave. Recalling his student days at Edinburgh, Cullen said, "I learned the system of Boerhaave; and except it may be the names of some ancient writers, of Sydenham, and a few other practical authors, I heard of no other names of writers on physic; and I was taught to think the system of Boerhaave to be very perfect, complete and sufficient.” After Cullen became professor of medical theory at Edinburgh in 1766, he began to appreciate fully the power of the Boerhaave 'tradition'. When he differed from Boerhaave, daring to give his own opinions, he was assailed as a whimsical innovator and his doctrines were disparaged by the medical community. In his autobiography, Cullen acknowledged that he was asked to avoid differing from Boerhaave, "for such conduct was likely to hurt myself and the University also."

Through his position from 1701 to 1738, Boerhaave re-established Leyden as the unrivaled center of university medical education. He so dominated its medical teaching that between 1718 and 1729 he held three of the five chairs and offered at least twenty hours of lectures per week. Albrecht von Haller called him 'communis Europae praeceptor,' the common teacher of Europe, and as such Boerhaave attracted many foreign students from all parts of Europe. By writing medical textbooks, Boerhaave also influenced countless medical students and practitioners in Germany, France, England, Italy and other countries. The Institutiones medicae (1708) enjoyed forty-five editions and provoked fifty-one commentaries. Similarly, the Aphorismi de cognoscendis et curandis morbis (1709) went through forty-five editions and stimulated eighty-three commentaries. His medical contemporaries considered his words as if from an oracle. A letter from China simply addressed, "Mr. Boerhaave, Physician in Europe", symbolized Boerhaave's incomparable fame. In short, Boerhaave was one of the most recognizable names in the field of medicine in his time.

However, Boerhaave's reputation has not survived the test of time. It was transmitted to the next generation by his most gifted pupils, Albrecht von Haller and Gerhard van Swieten, who wrote laudatory commentaries on his textbooks. Yet, during the following two centuries, his fame has became obscured, and his reputation has been challenged. Some medical historians wonder how he achieved the unusually high esteem of his contemporaries. Furthermore, a few medical historians have suggested that Boerhaave made no original contributions to medicine, and that his work hindered the progress of the medical sciences by presenting medical knowledge in a self-sufficient and closed system. In this context, a paper entitled "Is Boerhaave's fame deserved?” was read at the International Symposium in Commemoration of the Tercentenary of Boerhaave's Birth in 1968 under the aegis of Leyden University. In the same year, GA Lindeboom's biography examined the basis of Boerhaave's fame and questioned whether or not it was deserved.

From Boerhaave's death to the present, considerable literature has focused on the question: "what was the position of Boerhaave in the eighteenth century medicine?" Over the last two centuries writers on Boerhaave have given different answers to the question, depending on the individual writer's point of view. As understanding of the eighteenth century medicine has changed, historical assessments of Boerhaave have also changed. Compared with the eighteenth-century medicine, mathematics and physics of the same period, appear simple and straightforward. Medicine is rather a complex mixture of old and new, containing both traditional
and rational elements.

In the late seventeenth century, the Galenic system, slightly modified by ancient and medieval authorities, still dominated medicine. Yet, it had many new discoveries to assimilate: the circulation of the blood; the discovery of the lymphatic system and of glands and their ducts; the world of animalculae and particles disclosed by the microscope; the newer anatomical knowledge from dissection and from vascular injection; the rudiments of modern chemistry; and Newtonian physics. Along with other intellectuals undergoing a crisis in the seventeenth century, most physicians were skeptics. Diverse theorists such as iatrochemists and iatromechanists debated the physiology of man and appropriate therapeutics. While the old order remained dominant, it was changing gradually and could not reject the new. In short, seventeenth-century medicine was in many ways of confusion. Whether they praise or criticize him, few scholars disagree that it was Boerhaave who provided the eighteenth-century medical world with a unified system of knowledge. Aside from the question of whether his system was of long-term utility, he satisfied his contemporaries' needs by blending fact and theory, fusing old and new into an organized complete system.

In this paper, we will examine how historical assessments of Boerhaave have changed over the last three hundred years. The question about Boerhaave's position in the eighteenth century medicine will serve as a pivotal idea for the evaluation of the Boerhaave literature, including the writings of Boerhaave's contemporaries, and important works on Boerhaave such as those of Lindeboom, King, and Underwood. Unfortunately we can not deal with the abundant Dutch scholarship on Boerhaave.

Hermann Boerhaave's position in the eighteenth-century medicine

Historical assessments of Boerhaave fall into four classes. The first assessment was by Boerhaave's contemporaries who wrote about him after his death. Such writers were friends or pupils, and their writings were based upon first hand knowledge of the man. Secondly, there was the nineteenth-century critique of Boerhaave as a medical scientist, which re-evaluated Boerhaave in the light of his contributions to medicine and in terms of his scientific reasoning. Nineteenth-century writers took a narrow view of Boerhaave's scientific activity. Their approach was geared more towards an assessment on the basis of philosophy of science than on history. A third approach taken by several scholars has endeavored to illuminate Boerhaave's life and his various work in the social and medical context of the eighteenth century. Lindeboom and Underwood, in particular, have tried to re-assess Boerhaave in response to his nineteenth criticis. Lindeboom and Underwood have attempted to counteract what they believed was a scarcity in the quality and quantity of Boerhaave scholarship. Finally, there are those within the scientific community, medical or otherwise, who have described Boerhaave as an important contributor to their fields. Until recent times, these specialists have studied Boerhaave's work as point of origin or part of the lineage for their field.

The four groups are not entirely distinct. Each group shows more or less a certain tendency in its approach to Boerhaave and his work. Yet, each of the four groups represents a separate chronological phase in the historical study of Boerhaave. Their historical perspectives were influenced by the period when the author lived, his nationality, and so forth.

Writings on Boerhaave immediately after his death are filled with admiration, even veneration, for his personality and talents. In 1739, the next year of Boerhaave's death, Samuel Johnson wrote an account of Boerhaave's life in the Gentleman's Magazine. Johnson described Boerhaave as "so loudly celebrated, and so universally lamented throughout the whole learned World." Robert James reprinted Johnson's article on Boerhaave in his Medicinal Dictionary (1743) with very few alterations, and with additional comments on Boerhaave's importance in medicine.

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Some eighteenth-century authors also assessed Boerhaave's scientific position and his personality. According to Robert James, Boerhaave believed that Hippocrates was the original source of all medical knowledge, and that later writers were little more than transcribers from him. Thus Boerhaave returned to Hippocrates and spent much time in extracting the methods and contents of medical studies from him. However Boerhaave also studied a few modern writers, especially Sydenham, and began to involve himself in the practice of chemistry and botany. James also pointed out that Boerhaave recommended a rational and mathematical inquiry into the causes of diseases and the structure of bodies. As to Boerhaave's philosophy of science, James argued that Boerhaave strongly advocated experimental knowledge, and criticized "those arrogant Philosophers, who are too easily disgusted with the slow Methods of obtaining true Notions by frequent Experiments, .... and are better pleased with the delightful Amusement of forming Hypothesis, than the toilsome Drudgery of amassing Observations."

James described well how Boerhaave's system had been formed. Boerhaave based his medical knowledge upon
Hippocrates, added a few modern writers such as Sydenham, applied Newtonian mechanics to medicine, and tried to use experimental, inductive method while avoiding hypothesizing deductive methods.

But how was it possible for Boerhaave to utilize an experimental methodology of modern science and at the same time to accept the classical tradition of Hippocrates? How did he reconcile these without significant incongruity or disharmony? In his analysis of Boerhaave, James never posed such questions. Neither did William Burton in 1743 when he wrote a biography of Boerhaave, An Account of the Life and Writings of Hermann Boerhaave. Burton, who had studied under Boerhaave for six years, published a sympathetic account of his teacher. For contemporaries, Boerhaave's system, and his use of various but sometimes contradictory approaches, made perfect sense, however strange they may be to modern eyes. Contemporaries believed that Boerhaave had succeeded in building a harmonious system of knowledge because of his eclectic approach. According to James, Boerhaave "added Physic to Divinity, Chemistry to Mathematics, and Botany to Anatomy. He examined Systems by Experiments, and formed Experiments into Systems. He neither neglected the Observations of others, nor blindly submitted to celebrated Names. ... He examined the Observations of other Men, but trusted only to his own." Since the eighteenth century was an age of systematization of existing knowledge, as in the case of Cartesian system, Boerhaave's contemporaries welcomed his system as truth, when he combined the old with the new, and he tried to apply recently acquired knowledge to the old system.

From their vivid memory of Boerhaave, the contemporaries recalled his personality with admiration and reverence. It is remarkable that contemporary writers were as one in praising Boerhaave's personality. Those who experienced the influence of his personality said that Boerhaave's upright character generated more respect than his intelligence and intellectual achievement. Haller, one of Boerhaave's most eminent students, expressed his view that the coming centuries might produce an intellectual genius equal to Boerhaave, but scarcely his moral equal. In a similar vein, James said, "his Knowledge, however uncommon, holds, in his Character, but the second Place; his Virtue was yet much more uncommon than his Learning. He was an admirable Example of Temperance, Fortitude, Humility, and Devotion. His piety, and religious Sense of his Dependence on God, was the Basis of all his Virtues, and Principles of his whole Conduct." In their descriptions of Boerhaave, these writers showed little detachment. They were unanimous in thinking that it was Boerhaave's magnetic personality that attracted many students from abroad.

Contemporaries of Boerhaave, whether they were Dutch or foreigners, doubted that Boerhaave's contribution to medical science would fade. Before his death, however, Boerhaave said modestly to a Swiss pupil, Theodore Tronchin, that he would soon be forgotten like his seventeenth-century predecessor Sylvius, and that it should be so. Yet, his contemporaries and students had a strong conviction that Boerhaave was not a passing star in the medical firmament, but a unique figure of lasting significance. His English pupil and biographer Burton asserted that the world was indebted to him for "such writings, as shall do honor to his name, when magnificent edifices with glaring inscriptions to immortalize their founders shall be buried in oblivion." As students of Boerhaave transmitted his work to the next generation in the form of commentaries, Boerhaave's influence and fame continued until the end of the eighteenth century.

In the mid-nineteenth century, people started to question the extraordinary praise Boerhaave enjoyed during his lifetime and thereafter, and to re-evaluate his work critically. In 1870, the French medical historian, Charles Darenberg, wrote that Boerhaave's writings did not display particular merit: "The Aphorisms and the Institutiones possess neither depth nor anything surpassing the measure of ordinary human insight; they are neither new in form, nor is their teaching exalted or previously unheard." In 1900 Clifford Allbutt, then regius professor of medicine at Cambridge, also criticized Boerhaave severely, "Perhaps no physician ever enjoyed so great a fashion with so little scientific merit." Even in his clinical teaching, wrote Allbutt "Boerhaave showed less insight and skill than his pupil Van Swieten." Allbutt added that Boerhaave "seems to have made no experiments, and, in his writings at any rate, to have contented himself with hashing up the partial truths and the entire errors of his time. He was essentially iatro-mechanic, and this chiefly on mere reasoning; a bad example." In 1918, Van Leersum similarly stressed Boerhaave's lack of originality in medicine, and Ernest Cohen did the same for Boerhaave's chemical work. All of these writers focused on the originality of Boerhaave's scientific works, doubting whether it contributed to the development of modern medicine.

Why were the nineteenth-century criticisms so severe? First of all, in the nineteenth century, Boerhaave's system as a whole turned out to be of little use either in clinical medicine or in basic sciences. Nineteenth-century scientists were influenced by the ideal of positivism, and no physician then would try to advance a complete 'system.' Accumulation of experimental data also revealed that Boerhaave's system was founded on false assumptions and erroneous facts. Expressing a skeptical reaction to Boerhaave's unusual fame in the past
century, these writers judged upon the basis of what Boerhaave contributed to modern science. They failed to see the value of Boerhaave's broad scientific activities in medical teaching, or of his botanic garden. Ultimately they separated the man from his scientific activities.

A more sophisticated criticism of Boerhaave appeared in the middle of the twentieth century. In 1958, in *The Medical World of the Eighteenth Century*, Lester S King devoted two chapters to Boerhaave. In the first chapter, 'Hermann Boerhaave, Systematist,' King appreciated Boerhaave's great contribution in constructing a body of teaching that served as a standard for medical education and practice. However, he argued that the resulting system was monolithic and consequently restrictive. King wrote that Boerhaave's theory continued to prevail through the eighteenth century until enough data were accumulated for it to be discarded. King argued that Boerhaave provided the medical world with a complete, well rounded doctrine, wherein each part dovetailed smoothly with the next. Boerhaave's medicine had the specious appearance of a thoroughly logical structure, but only because the inferences were largely circular, elaborated from unproved hypothesis. In the second chapter, 'Hermann Boerhaave, Scientist', King also criticized Boerhaave's scientific reasoning. Although Boerhaave believed that a physician should base his knowledge on facts, experiments and reasoning, he sometimes showed defects in his reasoning. King's criticism of Boerhaave centered on his failure to follow sound inductive reasoning, the principles of which had been laid down by Francis Bacon the century before. Bacon offered inductive reasoning as scientific method: begin with observed facts, proceed carefully with progressive stepwise induction, generalize cautiously, and avoid tautological vacuities. According to King, Boerhaave jumped to broad conclusions, which he treated as first principles, and from them deduced subordinate principles, proximal explanations, etiological factors, and rules of therapy. He then presented them as established truths. This kind of reasoning led Boerhaave to select data fit to his theory, and to ignore or deny what he could not fit to his own theories. In short, King assessed Boerhaave's position in science on he basis of this closed system, a system which was not adaptable to change and hindered the new discovery of fundamental truths.

Based upon his extensive studies on Boerhaave's work, King's argument is both powerful and valid. Yet, it is valid in so far as it concerns the philosophical analysis of Boerhaave's system. From the perspective of philosophy of science, Boerhaave's system can be legitimately regarded as a dead-end filled with tautologies, discrepancies, and contradictions. In reality, however, Boerhaave accomplished more than his theoretical system. He created a medical curriculum and taught many students. He functioned also as a transmitter of medical knowledge from the seventeenth to the nineteenth century.

In response to the criticism of Boerhaave which persisted from the mid-nineteenth to the mid-twentieth century, a new movement to re-assess Boerhaave arose in the late 1960s when the Netherlands commemorated the tercentenary of Hermann Boerhaave's birth. At an International Symposium on Boerhaave, held at Leyden University in 1968, scholars sought to reassess Boerhaave in relation to the scientific, and medical world of early eighteenth-century Leyden. The symposium succeeded in re-illuminating Boerhaave from various angles.

Fifteen years before the symposium, GA Lindeboom, a professor of internal medicine in the Free Reformed University of Amsterdam, began to study Boerhaave, first searching for material by and about him. In 1959 Lindeboom published *Bibliographia Boerhaaviana*, in 1963 *Iconographia Boerhaavii*, and from 1962 to 1964 *Boerhaave's Correspondence*. Lindeboom also published many articles on Boerhaave. In 1968 his biography of Boerhaave represented the culmination of his efforts. Before Lindeboom's biography, many articles, and a few short books, dealt with one or another aspect of Boerhaave's life, but none included a comprehensive survey. Lindeboom gave a historical account of Boerhaave's life, and an examination of his personality, thought, and academic accomplishment as clinician, botanist, chemist, and teacher. Keenly aware of Boerhaave's critics, Lindeboom aimed at illuminating him as a whole and placing him in the context of the eighteenth-century Netherlands.

Lindeboom pointed out that Boerhaave made several significant contributions to science and medicine. He was the first to separate urea from urine. He introduced the thermometer to the bedside, and described spontaneous rupture of the esophagus. Nevertheless, Boerhaave was, Lindeboom conceded, a 'transmitter' and 'transmuter' rather than a creative mind. By systematizing existing knowledge and data, Boerhaave drafted a complete, all-embracing theory of medicine wherein all known facts received their proper place. According to Lindeboom, this complete system answered the momentary demands of the medical world which was in a state of debate and skepticism.

To the question, "what are Boerhaave's real merits?", Lindeboom answers that Boerhaave was, first of all, a
teacher. His influence spread from the little Dutch university town all over Europe, first, through his students; secondly, through his books; and finally, through his example. Boerhaave established the modern medical curriculum which began with the basic sciences of chemistry and botany, and then moved on to the study of human anatomy and physiology, and after that to pathology and therapeutics. In clinical teaching, Boerhaave followed Hippocratic method, emphasizing bed-side observation. Bed-side teaching was not new, but the significance that Boerhaave attached to it within the framework of university education proved extremely important. Other medical schools followed Leyden's organization of medical teaching and research. Gerhard van Swieten re-organized medical education at the Vienna school along the lines of Leyden as did Albrecht von Haller at Göttingen. In the English speaking world Boerhaave's influences was equally significant. In 1726, a group of Boerhaave's pupils founded Edinburgh medical school, based upon his teaching methods and curriculum.

In 1932 Innes Smith published a list of English-speaking medical students at Leyden. They came from throughout the British Isles and from the British colonies overseas. In his book Boerhaave's Men at Leyden and After, EA Underwood also studied a number of Boerhaave's English-speaking students at Leyden, and their activities after returning home. During his thirty-seven years, Boerhaave drew almost 2,000 matriculated medical students, of whom 746 were English-speaking. Using extensive statistical data, the author demonstrated the extraordinarily strong link that existed between the British medical community and Boerhaave's ex-students. For example, fifty-five of them became Fellows, Licentiates, or Extra-Licentiates of the Royal College of Physicians of London. Fifty achieved similar renown at Edinburgh and twenty-eight at the Irish College of Physicians. Underwood provides short biographies of Boerhaave's men, but he offers no substantial discussion of the nature of their intellectual debts to Boerhaave. He uses very few unpublished sources. Nevertheless Underwood's book shows how Boerhaave's influence spread to the English-speaking world.

However efficiently they defended Boerhaave from the critics, Lindeboom and perhaps Underwood and Smith, may have been guilty of a certain amount of hero-worship. Lindeboom frequently tried to defend his subject from all sorts of charges, even concerning Boerhaave's attitude toward money. He strongly emphasized that Boerhaave's unusual personality as well as his universal scholarship was the secret of his vast influence over the medical world. Lindeboom thought that at the risk of being charged with national chauvinism, he could not but say that Boerhaave was a really great men.

Although he aimed to place Boerhaave in his time, Lindeboom's main sources were writings by Boerhaave, his pupils, and friends. Since he quoted and used mostly the writings of Boerhaave-admirers, reiterating their opinion was probably inescapable. For the same reason, he failed to ask such questions as why Leyden became the center of medical teaching at that time? What social, political, intellectual conditions in the Netherlands made Boerhaave an eminent European teacher? Although Lindeboom provided some points about Boerhaave's debt to his scientific contemporaries such as Newton, Boyle, Bacon, and Descartes, he seldom mentioned the influence of the Dutch environment on Boerhaave. An important attraction was the atmosphere of religious freedom in the Netherlands, which drew Protestant students from northern Europe and the British Isles.

In the late twentieth century, Boerhaave's contributions to science have been re-evaluated. Historians of various sciences have written about Boerhaave, crediting him with specific contributions to their respective fields. SL Knutson argued that Boerhaave discovered the vessels carrying the aqueous humor from the eye. The author praised Boerhaave because although Boerhaave was not an ophthalmologist, he discovered the vessels armed only with a magnifying glass. Knutson wrote that Boerhaave "was a master of the general science of medicine with a passionate belief in careful and thorough observation." Boerhaave also has been applauded for his early recognition of the axial flow of the solid particles of the blood stream, his discovery of blood clotting and intravascular aggregation, and his pioneer work in the field of thrombosis. These writings are by specialists for a specialized scientific audience. Such authors do not see or appreciate Boerhaave's medical system as a whole, or in its historical context. They read selectively, emphasizing the particular passages that seem to represent the origins of their field. Often such elements are taken out of context, and without understanding the emphasis that Boerhaave placed upon them in his system. For example, what Boerhaave discovered was not thrombosis or blood-clotting as a function of disease, but as characteristics of the blood system in normal physiology.

Nevertheless, the writings on Boerhaave by specialists have made him a contributor to modern science as well as a medical teacher.

Conclusion

To return to the main question, what is the position of Boerhaave in the eighteenth century medicine?
Boerhaave's contemporaries believed that he was a man of science who not only mastered the old system of knowledge but also discovered mysteries of nature through experiment and observation. For the nineteenth- and early twentieth-century historians and scientists, Boerhaave did not appear to deserve such a high fame. Since Boerhaave's system could not serve as a basis for modern science, and was intrinsically flawed, they criticized Boerhaave for having hindered scientific progress by forcing a closed system upon younger generations. To these criticisms, Lindeboom and Underwood responded with extensive historical research, attempting to re-assess Boerhaave in the context of the eighteenth century. An effective strategy, it allowed Boerhaave again to be seen in a broader context. Both scholars seem to feel affinity with Boerhaave, in large part because of their nationality: Lindeboom is a professor in the Netherlands, and Underwood, a British physician, appreciated Boerhaave for the influence he exerted upon British medicine.

Lindeboom's work is the most important assessment of Boerhaave's position in the eighteenth century medicine. He endeavored to understand what Boerhaave did in the eighteenth century, and to evaluate the impact he made upon subsequent generations. Lindeboom has suggested that while Boerhaave did not possess a truly creative intellect, he was a significant figure as an educator, transmitter, and transmuter of knowledge. However, Lindeboom's work remains unsatisfactory because of its limitations in scope and use of sources. Boerhaave's position can be understood only when we understand fully the intellectual, institutional, and social environment of the eighteenth century Netherlands. Then, we will be able to determine the factors that influenced Boerhaave's life and professional accomplishments, as well as measure the influence he exerted.

Almost all students of Boerhaave and his contributions have been medical doctors or scientists. Boerhaave was a collector of many exotic plants which he placed in his Botanic Garden. His plant collecting was primarily for educational purposes, but his collection was later used by Linnaeus in his classification work. Although Boerhaave's gardening activities were not insignificant, they do not qualify as 'scientific' to those who apply a narrower definition of the word. Those who criticize Boerhaave for being non-scientific judge him on the basis of their own ideas about science and what constitutes sound scientific methodology. But in criticizing Boerhaave in this way, they apply narrow and exclusive concepts of science. As a result, their assessments deal more with issues of philosophy of science than with history.

KEY WORDS : Hermann Boerhaave, Eighteenth Century Western Medicine