Herman Boerhaave

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Herman Boerhaave (1668-1738)
Calvinist chemist and physician

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For my parents

Every man's work, whether it be literature or music or pictures or architecture or anything else, is always a portrait of himself, and the more he tries to conceal himself the more clearly will his character appear in spite of him.

SAMUEL BUTLER, *The Way of all Flesh*

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Abbreviations used

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Manuscript Collections

Leningrad MS	Boerhaave papers in the Kirov Manuscript Collection in the Military Medicine Library in St. Petersburg.
Leiden MF	Boerhaave papers in the Kirov Manuscript Collection on microfilm in the University Library in Leiden.

Works

Orations	Luyendijk-Elshout, A.M., & Kegel-Brinkgreve E. (1983) *Boerhaave's Orations*. Leiden, 1983.
Epicurus	Boerhaave, H., (1689). 'Oratio de bene intellecta Ciceroni sententia Epicuri de summo hominis bono' in *Orations* (pp. 31-53).
CSH	Boerhaave, H., (1701). 'Oratio de commendando studio Hippocratico' in *Orations* (pp. 65-84).
URM	Boerhaave, H., (1703). 'Oratio de usu ratiocinii mechanici in medicina' in *Orations* (pp. 94-120).
RMS	Boerhaave, H., (1709). 'Oratio in qua repurgatae medicinae facilis asseritur simplicitas' in *Orations*, (pp. 127-144).
CCP	Boerhaave, H., (1715). 'Sermo academicus de comparando certo in physicis' in *Orations* (pp. 155-179).
CSEE	Boerhaave, H., (1718). 'Dissertatio de chemia suos errores expurgante' in *Orations* (pp. 193-213).
SAC	Boerhaave, H., (1729). 'Sermo academicus quem habuit quum honesta missione impetrata botanicam et chemicam professio-

	nem publice poneret XXVIII Aprilis 1729' in *Orations* (pp. 222-236).
HMS	Boerhaave, H., (1731). 'Oratio de honore medici, servitude' in *Orations* (pp. 246-263).
Commentariolus	Boerhaave, H. 'Commentariolus de familia, studiis, vitae cursu, &c. propria Boerhaavii.' Trans. Lindeboom, G.A. *Herman Boerhaave. The Man and his Work*. Ed. G. A. Lindeboom. London, 1968 (1743). 377-386.
Correspondence 1	Lindeboom, G.A., ed. *Boerhaave's Correspondence*. Vol. 1. Leiden, 1962.
Correspondence 2	Lindeboom, G.A., ed. *Boerhaave's Correspondence*. Vol. 2. Leiden, 1964.
Correspondence 3	Lindeboom, G.A., ed. *Boerhaave's Correspondence*. Vol. 3. Leiden, 1979.

Chemical Symbols

☉	Gold
☾	Silver
☿	Mercury
♁	Antimony
♀	Copper
♂	Iron
♃	Tin
♄	Lead
♳	Sulphur

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Introduction

Just after Boerhaave's death in 1738 the following obituary, written by Samuel Johnson, appeared in the English *Gentleman's Magazine*:

> Dr. *Boerhaave* was a religious and modest Man, and so far from giving into the silly Affections of *Freethinking*, which *Pitca[i]rne* and some *English* Physicians valued themselves on, that he never made mention of the SUPREME BEING but to admire and exalt Him in His Works, and his written Advices were always accompanied with a short Prayer for the divine Blessing on his Endeavours. [1]

Nothing in Boerhaave's life was more important than his religion. His Calvinist beliefs not only dictated his way of life, but also guided his natural philosophical investigations. This book is about Boerhaave's Calvinism and about the way his Calvinism determined his chemistry and chemistry for medicine.

So far Boerhaave scholars have mainly discussed the question *how* Boerhaave constructed his natural philosophy and they have traced Boerhaave's ideas to their various original sources. Most notably, Lindeboom, in his extensive work on Boerhaave has described Boerhaave's ideas in much detail. [2] However, Lindeboom has presented a whiggish history in which he did not pay much attention to Boerhaave's viewpoints alien to modern science. For example Lindeboom never thought much of Boerhaave's alchemy and although he admitted that Boerhaave was a very religious man, Lindeboom did not ascribe any influence to Boerhaave's Calvinism upon his natural philosophy. Similarly Luyendijk-Elshout has not paid any attention to Boerhaave's Calvinism and she has argued that Boerhaave presented a thoroughly

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[1] *Gentleman's Magazine*, (1738): viii, 491, quoted in Lindeboom, G.A. (1968). *Herman Boerhaave. The Man and his Work*. Leiden: 261.

[2] Lindeboom published his work on Boerhaave in the series *Analecta Boerhaaviana*. Most important is his biography of Boerhaave: Lindeboom (1968). *Herman Boerhaave*.

mechanistic medicine.[3] Moreover, Harold Cook has recently argued that 'Boerhaave's medical teachings explicitly avoided any reference to immaterial powers' and that Boerhaave's faith had no major importance for his medicine.[4]

The central question of this book is not *how* but *why*? Why did Boerhaave develop his system the way he did? Why was he so keen on chemistry and why did he choose the discipline as one of the most important disciplines in medicine? Why did he attach so much value to experiment and observation? These questions are closely related to the questions Boerhaave himself asked while studying nature. What did he look for when doing chemical experiments? What was the purpose of his natural philosophical investigations?

Rather than viewing Boerhaave's pursuits from a modern scientific viewpoint, we have to go back to the early eighteenth century and contextualise Boerhaave's work.[5] Ever since the early nineteenth century, science and religion have become two separate realms with their very own questions and solutions. However this was not so in the early eighteenth century. When looking at Boerhaave's queries, we shall see that Boerhaave was not a founding father of modern science as such, but he answered questions and issues of his own time. He was not driven by the motive of developing an objective science independent from religion. On the contrary, we shall see that Boerhaave's natural philosophy was firmly rooted in his Calvinism.

The idea of breaking down the image of a former scientific hero and reconstructing his ideas is not new. As a result of the increasingly more important historical question as to what motivated intellectual pursuits many biographies have been or are in the process of being rewritten.[6] Moreover, it is

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[3] Luyendijk-Elshout, A.M. (1982). 'Mechanicisme contra Vitalisme. De School van Herman Boerhaave en de Beginselen van het Leven.' *Tijdschrift voor de Geschiedenis der Geneeskunde, Natuurwetenschappen, Wiskunde en Techniek, 5* (1), 16-26; See also the commentaries upon the orations: Luyendijk-Elshout, A.M., & Kegel-Brinkgreve, E. (1983). *Boerhaave's Orations*. Leiden.

[4] Cook, H. (2000). 'Boerhaave and the Flight from Reason in Medicine.' *Bulletin for the History of Medicine, 74*, 221-240: 221, 240.

[5] Fairly recently historians have advocated this historiographic approach. See: Wilson, A., & Ashplant, T.G. (1988). 'Whig History and Present-centred History.' *Historical Journal, 31*, 1-16; Ashplant, T.G., & Wilson, A. (1988). 'Present-centred History and the Problem of Historical Knowledge.' *Historical Journal, 31*, 253-274; Cunningham, A. (1988). 'Getting the Game Right: Some Plain Words on the Identity and Invention of Science.' *Studies in the History and Philosophy of Science, 19* (3), 365-389; Cunningham, A., & Williams, P. (1993). 'De-centring the Big Picture. The Origins of Modern Science and the Modern Origins of Science.' *British Journal for the History of Science, 26*, 407-432; Jardine, N. (1991). *On the Scenes of Inquiry: On the Reality of Questions in the Sciences*. Oxford.

[6] The re-evaluation of the works of scientific heros is the topic of a recent book by Theunissen and Hakfoort: Theunissen, B., & Hakfoort, C. (1997). *Newton's God en Mendels Bastaarden: Nieuwe Visies op de 'Helden van de Wetenschap.'* Amsterdam.

often the chemistry and alchemy, hitherto neglected and considered unimportant, which shows the 'other side' of many contemporary scientific heroes. A major example is the re-evaluation of the works of Isaac Newton. The discovery and study of his alchemical manuscripts has thrown a new light upon his physics, and historians have started to see that 'all issues of passivity and activity, or mechanical and non-mechanical forces, were enmeshed for Newton in a philosophical / religious complex.' [7] Recently historians have also reconsidered the projects of Robert Boyle. They have started looking at his chemistry and alchemy and as a result they have argued that Boyle was not as 'scientific' as historians have argued before. [8] In Boerhaave's case historians have similarly neglected the importance of theories and ideas which modern science has conveniently forgotten. However, I shall argue that in the forgotten ideas, such as for example the divine nature of fire, the chemical theory of menstrua and the idea of seminal principles, we find the motives for Boerhaave's pursuits.

Before looking at Boerhaave's ideas in more detail I shall use the introduction in order to present a picture of the world of which Boerhaave was a part. I shall also address the question why Calvinism was an important factor in the rise of natural philosophy in the Low Countries and what made Boerhaave's point of view specifically Calvinist as opposed to for example Lutheran or Arian. In order to understand the development of Boerhaave's chemistry for

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[7] Dobbs, B.J.T. (1991). *The Janus Faces of Genius. The Role of Alchemy in Newton's Thought.* Cambridge. 5. For a discussion of Newton's alchemy see also: Dobbs, B.J.T. (1975). *The Foundations of Newton's Alchemy. Or 'the Hunting of the Greene Lyon.'* Cambridge. See also the work of McGuire: McGuire, J.E., & Rattansi, P.M. (1961). 'Newton and the Pipes of Pan.' *NRRS, 21*, 108-143; McGuire, J.E. (1967). 'Transmutation and Immutability: Newton's Doctrine of Physical Qualities.' *Ambix, 14*, 69-95; McGuire, J.E. (1968). 'Force, Active Principles, and Newton's Invisible Realm.' *Ambix, 15*, 154-208; McGuire, J.E. (1973). 'Newton and the Demonic Furies: Some Current Problems in the History of Science.' *History of Science, 11*, 21-48; McGuire, J.E. (2000). 'The Fate of the Date: The Theology of Newton's *Principia* Revisited.' In M.J. Osler (Ed.), *Rethinking the Scientific Revolution* (pp. 271-295). Cambridge.

[8] See for example: Clericuzio, A. (1990). 'A Redefinition of Boyle's Chemistry and Corpuscular Philosophy.' *Annals of Science, 47*, 561-589; Clericuzio, A. (1993). 'From Van Helmont to Boyle. A Study of the Transmission of Helmontian Chemical and Medical Theories in Seventeenth-Century England.' *British Journal for the History of Science, 26* (303-334); Principe, L.M. (1990). 'The Gold Process: Directions in the Study of Robert Boyle's Alchemy.' In Z.R.W.M. von Martels (Ed.), *Alchemy Revisited Proceedings of the International Conference on the History of Alchemy at the University of Groningen, 17-19 April 1989.* (pp. 200-205). Leiden; Principe, L.M. (1998). *The Aspiring Adept. Robert Boyle and his Alchemical Quest. Including Boyle's 'Lost' Dialogue on the Transmutation of Metals.* Princeton; Principe, L.M. (2000). 'The Alchemies of Robert Boyle and Isaac Newton: Alternate Approaches and Divergent Deployments.' In M.J. Osler (Ed.), *Rethinking the Scientific Revolution* (pp. 201-220). Cambridge; Newman, W.R. (1996). 'Boyle's Debt to Corpuscular Alchemy; the Alchemical Sources of Robert Boyle's Corpuscular Philosophy.' *Annals of Science, 53*, 567-585.

medicine, I shall also briefly look at the place of chemistry at Leiden university and at contemporary debates on the importance of chemistry for physic.

Under Boerhaave's teaching the medical faculty at the university of Leiden flourished.[9] Yet, by the time Boerhaave was appointed to his first lectureship at the University of Leiden in 1701, the Low Countries were over the peak of the Golden Age and were about to start their 'Age of Decline.'[10] According to Israel the year 1702, marked by the death of Stadtholder William III and the start of the war of the Spanish succession, was the beginning of the way down. On a political level the anti-Orangists had abolished the position of Stadtholder and the Low Countries entered their First Stadtholderless period. The change was followed by fierce arguments and riots between Orangists and anti-Orangists over questions of influence and power, and continued until well into the eighteenth century. In addition to the political debates the Provinces were plagued by 'unilateral, as well as collectively agreed, troop and financial cuts, massive public debt, complaints about quotas, and deteriorating co-operation between the provinces.'[11] Internationally the Dutch, although still a nation to be reckoned with until the 1750s, faced the rising importance of other nations, such as Britain.

Not only politically, but economically as well the Low Countries became less important. During the 1720s the Dutch overseas trade started to falter and took the industries and fisheries with it. In agriculture the downwards trend which had begun in the 1660s intensified, especially with the outbreaks of cattle epidemics. As a result the urban population declined, most noticeably in the manufacturing towns of Leiden, Haarlem and Delft. The de-urbanisation, in turn, led to a decrease of the wealth of the middle class, which formerly had been the source of the general welfare of the nation. However, although there was less employment and the conditions were harder, there was no significant increase in poverty. Since many people left the towns, the

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[9] Boerhaave's teaching was very popular, even though the general list of the enrolment of students at Leiden University shows a decline from 1650. See: Israel, J. (1995). *The Dutch Republic. Its Rise, Greatness, and Fall, 1477-1806*. Oxford: 901.

[10] J. Israel, in his extensive discussion of the Low Countries in the early modern period, has called the years between 1702 (death of William III) and 1806 (collapse of the Batavian Republic), the 'age of decline.' Israel. (1995). *The Dutch Republic*. In the discussion on the Low Countries in the early eighteenth century I rely heavily on the work of Israel. See also: Jacob, M.C., & Mijnhardt, W.W. (1992). *The Dutch Republic in the Eighteenth Century*. New York. For an overview of the Dutch Golden Age see also: Price, J.L. (1998). *The Dutch Republic in the Seventeenth Century*. New York; Davids, K., & Lucassen, J. (Eds.). (1995). *A Miracle Mirrored. The Dutch Republic in European Perspective*. Cambridge; Schama, S. (1987). *An Embarrassment of Riches. An Interpretation of Dutch Culture in the Golden Age*. London.

[11] Israel. (1995). *The Dutch Republic*: 986.

people who remained could retain their living standards. Moreover, a new elite of rich regents, nobles and descendants of mercantile families, without an active economic role, appeared. Israel has argued that the Republic 'was still an affluent society compared with neighbouring countries. But it was a society in which the middle strata were being squeezed and wealth becoming more polarised than had been the case in the Golden Age.' [12]

By compensation, the intellectual life of the early eighteenth century was firmly rooted in the success of the seventeenth century, and its decline only started in the 1730s. Schaffer has argued that the stable political situation in the seventeenth century had enforced peace in learning. He repeats after an anonymous commentator in the 1690s that 'a prudent and balanced ''original system of government'' explained why the Dutch had so spectacularly '''Triumphed over Nature.''' [13] Cook has similarly argued that 'the social, economic, political and educational structures of the Low Countries [in the seventeenth century] provided the foundation of an intellectual revolution.' [14] In short, the seventeenth century political stability, relatively religious tolerant climate and thriving economy allowed Dutch natural philosophy to develop and flourish until well into the next century.

Boerhaave was very much a child of his time. Although the political and social-economic situation became increasingly difficult, Boerhaave worked in the intellectual arena as a natural philosopher, which means that the changes did not affect him very much. His earnings for private and university teaching as well as patient treatment fees, allowed him to lead a comfortable life. It can be said that Boerhaave was one of the new rich and he could afford to buy the estate Oud Poelgeest near Leiden, in addition to his house at the Rapenburg. Boerhaave was never much into politics. Given Boerhaave's disdain for the royal court, he presumably was not an Orangist. [15] This conclusion seems to be justified since Boerhaave also repeated after the anti-Orangist Gerard Noodt that religion should be free from the control of the magistracy. [16] Boerhaave was one of the last remnants of the seventeenth century intellectual Golden Age.

By the time Boerhaave started teaching in 1701, the major tensions in

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[12] *Ibid.,* 1017.

[13] Schaffer, S. (1989). 'The Glorious Revolution and Medicine in Britain and the Netherlands.' *Notes and Records of the Royal Society, 43*, 167-190: 168.

[14] Cook, H. J. (1992). 'The New Philosophy in the Low Countries.' In R. Porter & M. Teich (Eds.), *The Scientific Revolution in National Context* (pp. 115-149). Cambridge: 116. See also Hackman, W.D. (1975). 'The Growth of Science in the Netherlands in the Seventeenth and Early Eighteenth Centuries.' In M.P. Crosland (Ed.), *The Emergence of Science in Western Europe* (pp. 89-109). London.

[15] *Commentariolus*: XVII.

[16] Boerhaave to Cox Macro, 22 June 1710, *Correspondence 1*: 19.

Dutch academic life had faded away. Israel has argued that in the first decades of the century the differences in religion became less important in the widespread campaign against the followers of Spinoza, who were regarded as equivalent to free-thinkers. Israel states:

> Although the Republic resembled England, during the first two decades in the eighteenth century, in being a country where deism, and rejection of revealed religion, were commonly perceived to be widespread phenomena, Dutch society was unique in mounting such a sustained anti-deist and anti-atheistic offensive. [17]

Spinozism became an underground movement in the so-called 'Radical Enlightenment,' while at the same time 'physico theology' was the accepted natural philosophy in the Low Countries. The main aim of 'physico theology' was to show the works of God in the creation and the overthrowing of Cartesianism. Two major works at the time were Bernard Nieuwentijt's (1654-1718) '*Het Regt Gebruik der Werelt Beschouwingen,*' ('The Right Use of Contemplating the Works of the Creator,' 1715) and the '*Gronden van Zekerheid*' ('Grounds of Certainty,' 1720), in which he rejected the philosophies of Spinoza and Descartes and argued that a revealed God is evident in the details of nature. [18]

In the beginning of his career, Boerhaave himself was a victim of the witchhunt against Spinozists as he was accused of being a follower of the controversial philosopher. However, the allegations were partly unfounded and if it is at all possible to assign Boerhaave to a certain side in the debate, his natural philosophical investigations must be placed in the camp of the 'physico theologists.'

Boerhaave's Calvinism dictated the way he studied nature in two ways. Firstly, Boerhaave aimed at showing the wisdom of God in the divine works of creation and providence. Secondly, Boerhaave contrasted the power of God with the littleness of man and he emphasised the limitations of the human mind on every occasion. A combination of these two factors is particularly visible in Boerhaave's chemistry. For Boerhaave the peculiar powers of bodies show the active hand of God in nature, while at the same time chemical experiment and observation keep man from trying to understand the infinite height of the divine. In other words Boerhaave put great emphasis on

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[17] Israel. (1995). *The Dutch Republic*: 1041. For the controversies concerning the philosophy of Spinoza see also Israel's most recent work on the Radical Enlightenment: Israel, J.I. (2001). *Radical Enlightenment. Philosophy and the Making of Modernity 1650-1750*. Oxford.

[18] *Ibid*., 1014. For Nieuwentijt and physico-theology in the Low Countries see also: Vermij, R. (1991). *Secularisering en Natuurwetenschap in de Zeventiende en Achttiende Eeuw: Bernard Nieuwentijt*. Amsterdam; Vermij, R. (1999). 'Science and Belief in Dutch History.' In K. v. Berkel, A. v. Helden, & L. Palm (Eds.), *A History of Science in the Netherlands. Survey, Themes and Reference* (pp. 332-347). Leiden.

particular occurrences rather than general theory, for in the details of nature he could see God's active government of the creation. Moreover, the individuality of natural phenomena made him realise that trying to understand the works of God via the (Cartesian) method of mathematical reasoning was not only too ambitious, but also entirely impossible. Boerhaave considered God's divine works too great and too complex to fit into the enclosure of the human mind.

Boerhaave was not unique in emphasising the peculiar characteristics of bodies. The Dutch attention for detail is a striking characteristic of Dutch early modern natural philosophy, recently recognised by historians. Cook has argued that this natural philosophy was not particularly directed towards constructing a mechanical world view, but can be characterised as the exploration of detail.[19] Ruestow has done extensive research on the influence of the microscope upon Dutch intellectual life. He has argued that 'the microscope testified to an evermore intricate complexity in nature and a pervasive and continuing unexpectedness.' Unlike telescopic observations, which quickly got assimilated into general mathematical theory, microscopy 'underscored nature's capacity for endless surprise and for images that challenged the limits of the imagination.'[20] The attention for detail was not restricted to natural philosophy, for the arts, especially Dutch painting, reveal a great attention for details. Alpers has argued that Dutch art differs from Italian art. The latter is narrative. A painting represents another world and is based on prior texts or poems. Dutch art on the contrary is descriptive, and provides 'a portrait of [the Dutch] themselves and their country – its cows, landscape, clouds, towns, churches, rich and poor households, its food and drink.'[21] It is part of a visual rather than a textual culture, which according to Alpers also explains why the Dutch pay a lot of attention to experiment and observation.

Neither Alpers nor Cook have paid much attention to the importance of religion in the Dutch approach. Alpers has left Calvinism out of her account because in her view the picturing of the world is contrary to the Protestant emphasis on the Scriptures.[22] Cook has stated that strong claims on the relationship between 'science' and Protestantism must be treated 'with the same scepticism with which the 'Merton thesis' is treated by historians of English science.'[23] Rather than pointing to Calvinism, Cook has followed Hooykaas in stating that Catholic, Jewish and Protestant natural philosophers were uni-

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[19] Cook. (1992). 'The New Philosophy': 116.
[20] Ruestow, E.G. (1996). *The Microscope in the Dutch Republic. The Shaping of Discovery*. Cambridge: 4.
[21] Alpers, S. (1989 (1983)). *The Art of Describing. Dutch Art in the Seventeenth Century*. London: xvii.
[22] *Ibid.,* xxvi.
[23] Cook. (1992). 'The New Philosophy': 141.

ted in a Biblical humanism. This brings us to the question of how much of Boerhaave's thought was specifically Calvinistic and how much was part of a general Christian attitude towards studying nature? In other words, can we not say that Boerhaave only referred to God on numerous occasions because the convention of the time told him to do so and he wanted to make his ideas acceptable? This question is related to the question of how different Boerhaave's Calvinist God was from the God of other denominations?

Ever since the publication of Weber's *The Protestant Ethic and the Spirit of Capitalism* (1904), historians have been studying the relationship between Protestantism and the rise of science.[24] They have argued that the doctrine of predestination was of crucial importance in the creation of a particular work ethic in the seventeenth century in which science could flourish. Historians have argued that the idea of predestination created so much uncertainty about the state of man in the eyes of God, that the believer sought for signs of election in the fruits of his work. The rigid work ethic created a climate in which capitalism could flourish and in which the sciences could develop.

However, rather than the theory of predestination, which is not peculiar to Calvinism only, ideas on creation and providence are responsible for the rise of natural philosophy in the Low Countries. Calvinism distinguishes itself from all other confessions in its presentation of a God who determines absolutely everything on earth; from the life of plants and animals, to the origin of ideas in the human mind. Calvin had argued that man is entirely subjected to the will of God. As a result of the Fall he cannot do any good out of himself, but he entirely depends upon God's grace. Man is obliged to study the creation firstly out of thankfulness towards God who created him and secondly so that he can detect God's divine will in the nature of things.

Luther differed from Calvin in the sense that he had not been very interested in constructing a natural theology.[25] Luther argued that although God is immanent in the world, in the eucharist of the bread as well as in other things, yet His presence is inaccessible. Human sin has transformed all creatures into 'masks' of God, which means that God is 'hidden outside his revelation.'[26] Moreover, Luther regarded the existence of religion as sufficient

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[24] Weber, M. (1971 (1904-5)). *The Protestant Ethic and the Spirit of Capitalism* (Parsons, Talcott, Trans.). London; Merton, R. (1987). *Science, Technology and Society in Seventeenth Century England*. New York; Webster, C. (1975). *The Great Instauration. Science, Medicine and Reform 1626-1660*. London; Webster, C. (1982). *From Paracelsus to Newton. Magic and the Making of Modern Science*. Cambridge. Recently published is a set of essays edited by M. Osler, discussing the relationship between religion and the rise of natural philosophy. The essays not only look at protestantism, but also at other denominations. See: Osler, M.J. (Ed.). (2000). *Rethinking the Scientific Revolution*. Cambridge.

[25] Steinmetz, D.C. (1995 (1986)). *Luther in Context*. Michigan: 24.

[26] *Ibid.,* 24-25.

proof for the existence of God. This means that Luther points to the Scriptures rather than to the creation as the source of knowledge of God, while in the Dutch Calvinist creed, the creation is mentioned even before the Word as a means to know God. It must be said that the Lutherans, under the influence of Philip Melanchton did present a Lutheran natural philosophy, based on the idea of divine providence. [27] I shall discuss the difference between Lutheran and Calvinist natural philosophy at a later stage.

While Luther did not think about nature in the first place as a means to come to know God, Isaac Newton, on the other hand believed that 'there is no way to come to a knowledge of the Deity except by revelation or by the 'frame of nature.' [28] Yet, although Boerhaave probably read Newton's reflections on the omnipotence of God in the *Principia* and the *Opticks* with Calvinist eyes, Boerhaave's Calvinist God differed significantly from Newton's God. Newton's belief was anti-trinitarian and he also denied the immortality of the soul and the existence of spirits and the devil. [29] Snobelen has argued that Newton was eclectic in his beliefs and that he combined ideas from 'Anglicanism, Calvinism, Judaism, fourth-century Arian sects, seventeenth century radical theologies and his own exegetical innovation.' [30] Nevertheless I want to single out the influence of Arianism upon Newton's beliefs, for this shows particularly well how Boerhaave's God is different from Newton's.

Newton repeatedly said that 'the supreme God does nothing by Himself that He can do by others.' [31] This statement relates to the Arian belief that God is not concerned with the 'moment-to-moment movements of all particles of matter in the universe.' Instead God needs 'an intermediary for intercourse with the world.' [32] Hence Newton introduced an 'alchemical spirit' or 'universal vital activator' as the intermediary hand of God in His governance of the world. Moreover, the active principle of alchemy was closely related to

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[27] Kusukawa, S. (1995). *The Transformation of Natural Philosophy. The Case of Philip Melanchton*. Cambridge. See also Barker's recently published essay on Lutheran religion and its influence upon Lutheran scientific thought. Barker, P. (2000). 'The Role of Religion in the Lutheran Response to Copernicus.' In M.J. Osler (Ed.), *Rethinking the Scientific Revolution* (pp. 59-88). Cambridge.

[28] Dobbs. (1991). *The Janus Faces of Genius*: 255.

[29] Snobelen, S. (1999). 'Isaac Newton, Heretic: The Strategies of a Nicodemite.' *British Journal for the History of Science, 32*, 381-419: 386-387. See also: Force, J.E. (1994). 'The God of Abraham and Isaac (Newton).' In J.E. Force & R.H. Popkin (Eds.), *The Books of Nature and Scripture* (pp. 179-200). Dordrecht. For a discussion of Newton's religious views see also Manuel, F.E. (1974). *The Religion of Isaac Newton*. Oxford; Force, J.E. (2000). 'The Nature of Newton's 'Holy Alliance' between Science and Religion: From the Scientific Revolution to Newton (and Back Again).' In M.J. Osler (Ed.), *Rethinking the Scientific Revolution*. Cambridge.

[30] *Ibid.,* 416.

[31] Newton in: Dobbs. (1991). *The Janus Faces of Genius*: 213.

[32] Dobbs. (1991). *The Janus Faces of Genius*: 213-214.

Newton's concept of mechanical ether, gravity, electricity and later to the Arian Christ. Newton believed that the true knowledge of God and His will has been lost and he considered natural philosophy as the first step towards the restoration of truth. [33]

Boerhaave differed widely from Newton in this respect. He believed that God directly works in nature, not using a universal medium, but via the powers peculiar to individual bodies. Boerhaave's Calvinism had taught him to approach the creation with a humble mind and never to aim at the wisdom of God Himself. Hence Boerhaave emphasised the infinite variety of nature and the individual powers of all things as results of a first cause which remains hidden from man's eyes. Man can never fully disclose God's operating hand in nature, but he can only admire its working. Moreover, it is impossible to completely restore true knowledge, for man cannot even understand or perfect the structure of a simple hair. [34]

It can be said that although the study of the works of the creation was a recurring theme in all Christian theology alike, Calvinists placed an extra emphasis on the *obligation* of man to study God's creation. This is perhaps a reason why natural philosophy could flourish in a country were Calvinism was the state religion. This can also explain why Cartesianism could develop in the Low Countries. Although theologians turned away from Descartes' metaphysics, they at the same time allowed his mathematics and physics to be taught in the universities, for they must have seen it as a useful means to study nature.

The Calvinism of Boerhaave and of many contemporary 'physico-theologists,' also emphasised that the human mind is blinded by sin. Ruestow has argued that Calvinists were 'striving to recognise a revelation of God hidden not by the secretiveness of nature but by the moral depravity of man.' [35] Boerhaave expressed a Calvinist viewpoint when stating that man cannot come to true knowledge out of himself, but he depends upon God, who imprints true knowledge upon his mind. Thus man should not adopt a general theory of matter and motion in order to explain the world around him. Instead he should concentrate on chemical experiment in order to show the latent peculiar powers of bodies, which is the endless variety of the working of God's divine will in nature.

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[33] *Ibid.,* 247.
[34] *CCP*: 168.
[35] Ruestow. (1996). *The Microscope*: 78.

No-one seems to have studied Boerhaave's chemistry in detail with respect to his medicine.[36] Yet by 1718, when Boerhaave accepted the chair of chemistry, he regarded chemical skill and practice as one of the keystones of his whole medical approach. He gave an annual course of lectures, covering the history, theory and practice of chemistry, and in the practical part he discussed the medical use and application of virtually all the chemical preparations he taught. Moreover, in his teaching and writings on the powers of medicines and on *Materia medica* (1719), he makes much reference to the use of chemical preparations as drugs. These chemical works were very popular, being published in unauthorised editions by his students, and in authorised ones by Boerhaave himself. They were translated into several languages, and appeared in many editions.[37] Pupils of Boerhaave set up chemical teaching following the methods of their teacher, so the chemical approach to medicine that Boerhaave taught was very influential. However, it is not my purpose to discuss the impact of Boerhaave's ideas upon his students, for that would be the topic of another book. As said before I am more concerned with the contemporary ideas and questions shaping Boerhaave's natural philosophy.

In Boerhaave's day the proper relation of chemistry to medicine was a matter of keen dispute, with some eminent physicians and medical theorists, such as Georg Ernst Stahl in Germany, claiming that it had no role, others, especially the Helmontians, that it was crucial to medicine. In France and Britain the early seventeenth century witnessed fierce debates between Galenists and chemists. Traditional physicians protected their university courses against modern influences which meant that chemistry developed and flourished

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[36] For works looking at the relationship of chemistry and medicine in Boerhaave's work see: Gibbs, F.W. (1963). 'Boerhaave and the Place of Chemistry in Medicine.' In F.N.L. Poynter (Ed.), *Chemistry in the Service of Medicine*. London; Lindeboom, G.A. (1972). 'Boerhaave's Impact on the Relation between Chemistry and Medicine.' *Clio Medica, 7*, 271-278. For works on Boerhaave's contribution to the discipline of chemistry see: Metzger, H. (1930). *Newton, Stahl, Boerhaave et la Doctrine Chimique*. Paris; Gibbs, F.W. (1949). *The Life and Work of Herman Boerhaave. With Particular Reference to his Influence in Chemistry*. Unpublished Ph.D., London; Jevons, F.R. (1962). 'Boerhaave's Biochemistry.' *Medical History, 6*, 343-362; Partington, J.R. (1961). *A History of Chemistry*. New York: ii, 740-759; Cohen, E. (1919). *Herman Boerhaave en Zijne Betekenis voor de Chemie. Met een Vertaling van Boerhaave's Natuurwetenschappelijke Redevoeringen en Verhandelingen door Dr. Margaretha Renkema*. De Nederlandse Chemische Vereniging in Samenwerking met de Vereniging voor Geschiedenis der Genees-, Natuur-, en Wiskunde; Christie, J.R.R. (1994). 'Historiography of Chemistry in the Eighteenth Century: Herman Boerhaave and William Cullen.' *Ambix, 41*, 4-19. For a general survey on the importance of chemistry for medicine in the seventeenth and early eighteenth century see: Debus, A.G. (2001). *Chemistry and Medical Debate. Van Helmont to Boerhaave*. Canton, MA. For a history of medicine in the eighteenth century see the work of L. King: King, L.S. (1958). *The Medical World of the Eighteenth Century*. Chigago; King, L. (1963). 'Rationalism in Early Eighteenth Century Medicine.' *Journal of the History of Medicine, 18*, 257-271.

[37] See Lindeboom, G.A. (Ed.). (1959). *Bibliographia Boerhaaviana*. Leiden.

mainly outside the universities in newly founded learned societies like the Royal Society in London and the *Jardin des Plantes* in Paris.[38] Only slowly did chemical remedies become accepted among Galenic physicians but iatrochemistry never really got a place in the official medical curricula. As a result the main function of chemistry for medicine was pharmaceutical. Chemistry proved to be a great help in the preparation of cures, but it was looked upon with suspicion in the explanation of bodily processes. Alan Debus has suggested that this was mainly due to the popularity of the mechanical philosophy, which ruled out chemical theory.[39] Especially under the influence of the works of the Italians Borelli and Bellini, the mechanics of motion of the fluids became a central concern in medical theory.

Although the debate between iatrochemists and traditional physicians raged in Britain and France, it did not so much affect the Low Countries. Under Franciscus dele Boë Sylvius, who was elected to the chair of medicine at the university of Leiden in 1658, medical teaching flourished. Sylvius advocated a chemical medicine that went back to the iatrochemistry of Paracelsus and Van Helmont. He tried to explain all physiological and pathological processes in the body through the interaction of acid and alkali, which he named the fundamental principles of nature.[40] This means that he classified the classic humours according to their acidity; saliva is neutral, the pancreatic juice slightly acid and bile is alkaline. Illness results from an upset balance of the humours and a cure consists in neutralising the condition of acridity, i.e. the excess of either acid or alkali in the body.[41] The strong chemical tradition at the University of Leiden continued with the building of a chemical laboratory in 1669. The director, Carel de Maets (Dr Desmatius), became the first professor of chemistry, followed by Jacob le Mort in 1690. However, by that time chemistry had declined from a most important basis to not more than a help to medicine. For Le Mort, an apothecary's son, chemistry was only useful in the preparation of drugs.[42] The chemical laboratory declined under his

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[38] For debates in France see: Debus, A.G. (1991). *The French Paracelsians. The Chemical Challenge to Medical and Scientific Tradition in Early Modern France*. Cambridge. For England see: Jones, R.F. (1961). *Ancients and Moderns. A Study of the Rise of the Scientific Movement in Seventeenth Century England*; Clericuzio. (1993). 'From Van Helmont to Boyle.' See also: Debus, A.G. (1987). *Chemistry, Alchemy and the New Philosophy, 1550-1700*. London.

[39] Debus. (1991). *The French Paracelsians*: 154.

[40] Beukers, H. (1982). 'Mechanistische Principes bij Franciscus dele Boë, Sylvius.' *Tijdschrift voor de Geschiedenis der Natuurwetenschappen, Wiskunde en Techniek, 5* (1), 6-15.

[41] Hannaway, O. (1965). *Early University Courses of Chemistry*. Unpublished Ph.D., University of Glasgow, Glasgow: 197-198.

[42] Lindeboom. (1968). *Herman Boerhaave*: 110.

care, so that Boerhaave, who succeeded Le Mort in 1718, had to ask the curators of the university for many new utensils and materials.

It can be said that when Boerhaave started his private lectures in chemistry in 1702 his bed was already made. Hannaway has argued that 'the chemistry laboratory at Leyden should be seen as part of an overall educational pattern to train professional people in practical skills useful to the community.' [43] As chemistry was an accepted part of medical teaching, Boerhaave did not have to fight his position, nor did he have to choose between the viewpoints of the iatrochemists who explained all bodily processes in chemical terms, and the opinion of others, who claimed that chemistry had no place in medicine at all. Boerhaave was in the fortunate position of being able to study chemistry for medicine and develop a system that might look like a golden mean between two extreme views, as Lindeboom has suggested, but which was in fact a unique system, a 'new method of chemistry.' [44]

One of Boerhaave's contemporaries in the Low Countries was Johann Conrad Barchusen (1666-1723), university professor of chemistry in Utrecht from 1694 until 1723. According to Lindeboom, Barchusen preceded Boerhaave by almost a decade in promoting a chemistry which was not only ancillary to medicine but also had an independent status. [45] For Barchusen the primary aim of chemistry remained the preparation of medicines, but he also used chemistry in the investigation of the nature and qualities of bodies. [46] Barchusen, just like Boerhaave, warned against the chemists 'seeking to grasp faith and reason with their own hands,' thereby referring especially to Cartesian chemists promoting subtle ether theories. [47] Nevertheless Barchusen adopted Cartesian matter theory as well and he speculated about the sizes and shapes of the traditional Aristotelian elements salt, oil, water, and earth. He sought to understand the theory of chemistry behind the processes themselves and he 'is always trying to rationalise the chemistry of his preparations and draws on corpuscular and mechanistic theories to make them intelligible.' [48]

Boerhaave was an eclectic. He developed his own unique system by adopt-

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[43] Hannaway. (1965). *Early University Courses*: 209.

[44] Lindeboom, G.A. (1972). 'Boerhaave's Impact on the Relation between Chemistry and Medicine.' *Clio Medica, 7*, 271-278: 273. Shaw named his translations of Boerhaave's lectures *A New Method of Chemistry.*

[45] Lindeboom, G.A. (1972). 'Boerhaave's Impact on the Relation between Chemistry and Medicine.' *Clio Medica, 7*, 271-278: 214. See also Lindeboom, G.A. (1970). 'Barchusen and Boerhaave.' *Janus, 57*, 30-41.

[46] Hannaway, O. (1967). 'Johann Conrad Barchusen (1666-1723). Contemporary and Rival Of Boerhaave.' *Ambix, 14*, 96-111. See also Hannaway. (1965). *Early University Courses.*

[47] Barchusen in Hannaway. (1965). *Early University Courses:* 219-220.

[48] *Ibid.,* 242.

ing many ideas from contemporary chemists. In this book I shall discuss the influence of British natural philosophy upon Boerhaave's chemistry. At this point I shall briefly discuss the importance of French chemistry. Boerhaave not only often referred to the work of French chemists, but the changes in French chemistry show particularly well how Boerhaave's chemistry was at the same time different from and similar to the work of contemporaries.

In the seventeenth century the work of French chemists was very influential. In particular Nicholas Lémery's (1645-1715) *Cours de Chimie* (1675) was one of the most important chemical textbooks at the time.[49] According to the historian Hélène Metzger the popularity of Lémery'sJohann Conrad textbook was due to the fact that Lémery openly described chemical preparations that chemists and charlatans had kept secret before. His chemistry was also understandable by laymen as Lémery omitted all obscure language and theory, thereby presenting a straightforward chemistry.[50] Metzger states that:

> Lémery, like most of the thinkers of the time, accepted only mechanical philosophy; declaring any other interpretation of chemical phenomena, any addition to mechanism, absurd, the professor had no goal other than to give an intelligible explanation of the facts.[51]

Lémery presented a static chemistry in which he emphasised the constituent principles of nature. His main object was the separation of the purer substances of mixed bodies.[52] Consequently he spent most time explaining chemical operations. This is visible in his chemistry course as well as in his textbook. Normally Lémery spent only one day out of thirty four explaining the theory of chemistry and showing his furnaces, vessels and instruments. The biggest part of the course, which translates into 52% of his textbook, is devoted to the explanation of the operations on minerals. This is not surprising as according to Lémery the five chemical principles water, spirit or mercury, oil or sulphur, salt and earth are most difficult to find in the mineral kingdom. Lémery, unlike Boerhaave as we will see later, be-

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[49] For an extensive discussion on Lémery see: Bougard, M. (1999). *La Chimie de Nicolas Lémery.* Turnhout. For the emergence of textbook chemistry see: Hannaway, O. (1975). *The Chemists and the Word. The Didactic Origins of Chemistry.* Baltimore/London. For a discussion of Hannaway's thesis see: Christie, J.R.R. & Golinski, J.V. (1982). 'The Spreading of the Word: New Directions in the Historiography of Chemistry 1600-1800.' *History of Science, 20*, 235-266.

[50] Metzger, H. (1969 (1923)). *Les Doctrines Chimique en France du Début du XVIIe à la Fin du XVIIIe Siècle*. Paris: 32; Metzger, H. (1991 (1930)). *Chemistry* (Colette V. Michael, Trans.). West Cornwall, CT: 31-32.

[51] Metzger, H. (1991 (1930)). *Chemistry* (Colette V. Michael, Trans.). West Cornwall, *CT*: 32.

[52] Lémery, N. (1686). *A Course of Chymistry. Containing an easy Method of Preparing those Chymical Medicines which are Used in Physick with Curious Remarks and Useful Discourses upon each Preparation, for the Benefit of such who Desire to be Instructed in the Knowledge of this Art.* (Harris, W., Trans.). London: 1.

lieved that the substances resulting from a chemical experiment existed in the mixed body before. He calls these substances the principles of chemistry. However, they are only principles in respect to man since he cannot divide natural bodies any further. Nevertheless they come close to the true principles of nature and they 'will give us a very great idea of nature, and the figure of the first small particles which have entered into the composition of mixt bodies.' [53]

Lémery's chemistry in essence went back to the iatrochemistry of Sylvius. He defined the active principles, i.e. salts, sulphurs and spirits, according to the figure and shape of their particles. Moreover he divided the salts into acids and alkalis. Acids consist of pointed particles set in motion. Alkalis have porous parts so that the acid points can enter the composition and divide whatever opposes their motion. As a result of the acids breaking the resistance of the alkalis a violent ebullition occurs. This means that they can indicate each other's presence when combined together. Gradually Lémery's theory was widely accepted and it was believed that all substances, even the metals, were composed of acids and alkalis.

In Lémery's time the acid-alkali hypothesis was widely accepted and only changed after Robert Boyle argued that some substances are neither acid nor alkali, but are neutral. In order to show the presence of acids or alkalis he developed a colour indication test, which means that the presence of effervescence upon combining an acid and an alkali was no longer sufficient to prove the nature of a particular substance. Boyle showed that the combination of a particular substance with syrup of violets turns red if it is an acid and blue or green if it is an alkali. [54] By the time Boerhaave wrote his *Elementa Chemiae*, Boyle's ideas were widely accepted and Boerhaave strongly encouraged his students to read Boyle on the subject.

Unlike Lémery, Boerhaave presented an active chemistry based on the principle of motion. In that sense, Boerhaave's chemistry was closer to the chemistry of Etienne François Geoffroy (1672-1731), who is best known for his table of affinity in which he categorised natural bodies according to the strength of the forces of attraction between them. Geoffroy worked in the *Jardin Royal des Plantes Médicinales* (founded in 1640, in order to educate physicians and apothecaries). Although chemistry started off being part of the medical curriculum, it became gradually more independent in the beginning of the eighteenth century. From 1718 the focus of the *Jardin* moved away from

[53] *Ibid.,* 6.

[54] Boas, M. (1956). 'Acid and Alkali in Seventeenth Century Chemistry.' *Archives Internationales d'Histoire des Sciences, 9*, 13-28.

medicine to natural philosophy (*sciences naturelles*) and physico-chemical studies. The name changed accordingly into *Jardin Royal des Plantes*. [55]

Geoffroy advocated a Newtonian dynamic chemistry in which the principle of motion determined the nature of a particular substance. He divided chemical actions into fermentation and corruption or dissolution, either of which is caused by a particular kind of motion. If the motion is directed to unifying particles he speaks of fermentation and if it leads to destruction or dissolution of bodies he speaks of corruption. According to Geoffroy, nothing is more promising for the advancement of physic than knowledge of motion and change.

Geoffroy argued that only three principles are absolutely simple, i.e. the passive principles of water and earth and the active principle of fire. Salts result from a combination of these three principles, and are therefore called the most simple of all bodies. Sulphurs arise from a combination of the three principles and salt. Geoffroy mentioned fire as the first principle through which all bodies receive their activity. In doing so he moved away from the traditional opinion of the universal spirit being the first principle. For example, Lémery still believed in a universal spirit diffused through all bodies, even though he states that the principle is 'a little metaphysical' and therefore beyond discussion. [56]

As we shall see later, Geoffroy's definition of fire is similar to Boerhaave's. Geoffroy states that it 'is a simple and most subtle body in a continual swift motion filling and easily permeating the pores of all other bodies.' [57] The force of this fire is in proportion to the quantity of the substance in which it is found, which means that the fire is most active in the sun. The extreme subtlety and activity of the principle make it impossible for the chemist to produce fire in its purest form so that it always remains united with water and earth and in salts and sulphurs. The action of fire determines the character of water and earth, and therefore the nature of all bodies.

Alan Debus has traced the seventeenth century emphasis on the study of motion to the chemistry of Van Helmont and contemporaries, who believed that the principles of motion and life resulted from the divine will. So the study of motion essentially was seen as the study of God and His providence. [58] In

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[55] For a history of the *Jardin des Plantes* see: Laissus, Y. (1986). 'Le Jardin du Roi.' In Y. Laissus & J. Torlais (Eds.), *Le Jardin du Roi et le Collège Royal dans l'Enseignement des Sciences au* XVIIIe *Siècle* (pp. 287-341). Paris.

[56] Lémery. (1686). *A Course of Chemistry*: 3.

[57] Geoffroy, E.F. (1736). *A Treatise of the Fossil, Vegetable, and Animal Substances, that are made use of in Physick*. London: 9-10.

[58] Debus, A.G. (1973). 'Motion in the Chemical Texts of the Renaissance.' *Isis, 64*, 5-17.

recent years Debus has emphasised the importance of vitalistic principles in French chemistry. [59] Moreover, historians are becoming increasingly aware of the importance of non-mechanistic principles in the work of seventeenth and early eighteenth century chemists, leading up to the chemistry of Lavoisier and Black. [60] We shall see that Boerhaave's chemistry was also based on non-mechanic principles and that Boerhaave was no exception in valuing the works of Van Helmont highly, while investigating the effects of the principle of motion in the seeds of things.

The book has four chapters. In the first chapter I shall discuss the incident on the canalboat in which Boerhaave was accused of being a Spinozist. While looking at the question of how much truth was in the allegation I shall also look at Boerhaave's education, the influence of his teachers and on a more general level at the debates over Spinozism and Cartesianism in Dutch society and academia at the time. We shall see that Boerhaave was horrified by the theological consequences of Spinozism, but that at the same time he was attracted by Spinoza's ideas on freedom of thought.

The second chapter is devoted to a discussion of Boerhaave's Calvinism. Calvin's own work, in particular the *Institutes of the Christian Religion* (1559), will be the startingpoint of an investigation into Calvinist ideas on creation, providence and the question of how man can come to true knowledge. In turn this forms the basis of an evaluation of Boerhaave's Calvinist views concerning God's divine will visible in the creation as well as his views on the human mind. Boerhaave's ideas appear to be remarkably similar to those of Calvin.

The third chapter is about the practical application of Boerhaave's Calvinism in his chemistry. I shall pay attention to Boerhaave's definition of chemistry and how he presented a 'reformed' chemistry as distinct from the corrupt chemistry of the so-called false chemists and alchemists. Just as Calvin had argued that God diffused His divine energy in the creation, so Boerhaave introduced occult qualities in his chemistry as the agents of God's providence and divine will. Finally, Boerhaave's emphasis on the limitations of observation and experiment reflects his belief in the inability of man to achieve certainty about the first principles in natural philosophy.

Last but not least I shall look at Boerhaave's chemistry for medicine. Since Boerhaave's medicine changed over the years, an important part of the final chapter is devoted to a discussion of Boerhaave's intellectual development. The *Orations*, which Boerhaave gave at turning points in his career, show

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[59] Debus. (1991). *The French Paracelsians*: 207-208.

[60] See for example the work of Clericuzio on Boyle: Clericuzio. (1990). 'A Redefinition of Boyle's Chemistry;' Clericuzio. (1993). 'From Van Helmont to Boyle.'

how Boerhaave changed from a doubtful Cartesian into a chemist and physician very much concerned with the peculiar non-mechanical powers of bodies. For Boerhaave chemistry became increasingly more important in showing the individual characteristics of natural bodies and at last chemistry even subjected physics and mechanics to itself and became of crucial importance in medicine. The end of the chapter is devoted to the practical medical application of Boerhaave's chemistry of living bodies.

The book is mainly based on printed sources: Boerhaave's textbooks on chemistry and medicine, the academic orations and the few autobiographical notes found after his death. My intention is to stay as close to Boerhaave's own words as possible. However, I shall also use the commentaries and translations of contemporaries.

When starting the research I also planned to study the so-called Kirov manuscripts in St. Petersburg among which are lecture notes in Boerhaave's own hand, notes on chemical experiments and correspondence. Unfortunately I was unable to see the papers. Officials of the library of the military medicine academy, where the manuscripts are held, were faced with many problems concerning the collection and decided to refuse me entry. After much negotiating and the signature of a four-star-general, I was allowed to see the catalogue of the collection for a short while and after yet more talk the manuscripts themselves for a few hours. The librarians allowed me just enough time to make a list of important manuscripts on chemistry and alchemy, which is added as an appendix at the end of the book. Fortunately Lindeboom in the 1950s found a more lenient head of the academy and he was allowed to bring microfilms of the collection to the University Library in Leiden. However, Lindeboom mainly focused on Boerhaave's medicine and decided not to ask for films of all the chemistry and alchemy manuscripts. I have looked at the Leiden microfilms, but did not find much useful material on chemistry.

It can be said that Boerhaave was the most important medical teacher after Galen. His fame reached all over Europe and further afield. The story goes that a letter from China addressed to 'Mr. Boerhaave, Physician in Europe' was delivered to Boerhaave in Leiden.[61] Boerhaave himself never travelled further than Harderwijk, but at the same time corresponded with many people all over Europe. In the letters, Boerhaave not only gave medical advice, and discussed medical and chemical problems, but he also asked for seeds and

[61] For the origin of this story see: Marx, O.M. (1968). 'M. Boerhaave en Europe: The Origins of an Anecdote Explained.' *Journal of the History of Medicine, 23.*

plants in order to enrich the botanical garden in Leiden. His friends and colleagues were much obliged to him and apparently on a mountain somewhere in southern Europe is a memorial with the inscription: 'Though suffering from gout, Bassand has officially climbed to this point in order to gather plants for Boerhaave.' [62]

Boerhaave's name still lives on in the Netherlands. In Leiden we find the Boerhaave History of Science Museum, a statue opposite the hospital, a chemist called after the famous physician, and even an abortion clinic bearing Boerhaave's name! Almost every respectable town in the country has a street called after Boerhaave and in orthodox Calvinist circles the name Boerhaave stands for the only real Christian doctor the Dutch have ever known. Herman Boerhaave deserves the attention of historians and this book is an attempt to understand the driving motives of some of Boerhaave's intellectual endeavours.

[62] *SAC*: 231.