

DE RAEY: THE MOLE IN LEIDEN

**Cartesianism in 17th century
medical education**

HENDRIK PUNT

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Figure 1: Johannes de Raei (publisher: Universitaire Bibliotheken Leiden)

INTRODUCTION

Johannes de Raey (1622-1702) was one of the first Cartesians, and yet he managed to hold out at Leiden University for more than twenty years. In 1647, when he was a young private philosophy tutor, his contemporaries quickly sought to muzzle him. This took place against a hectic background of almost daily squabbles between the supporters and detractors of Descartes, which even led to actual physical fighting during debates, the ‘disputations. De Raey paid little heed to these conflicts and managed to continue his lessons in physics without interruption, and without making any real concessions to his Cartesian opinions. While he liked to embellish Cartesianism with the theories of Aristotle, and also added his own Praecognita to the discussion, he always remained faithful to the core values of the Cartesian Principia. Despite his sympathy for Cartesian theory, the predominately anti-Cartesian Senate and Curators of the University were still prepared to offer him highly desirable career opportunities in academia. He was made Professor of Philosophy and was given a teaching assignment in medicine, while he also filled vital administrative positions on the Senate. All the while, he continued to unwearingly spread the Cartesian message; not only in philosophy, but in medicine, too. But how did De Raey avoid a major confrontation with the Senate and the Curators?

The title of this book provides a clue: *De Raey: The Mole in Leiden*.

I shall discuss his scientific life in four phases. The corpuscular teachings of Descartes formed his chief source of inspiration in each of these phases, and this common thread forms an inextricable bond between each of these periods. Nevertheless, the substance of each period is different in each case; there is no single static concept of De Raey.

The first phase of his life involved his student years in Utrecht. In that age, it was customary for a student of medicine to spend his first year studying philosophy. It was during this first year that the accepted Aristotelian system of Peripatetic teaching was first called into question and Descartes’ new theories were introduced. The nineteen-year-old De Raey was one of the first students to witness the rise of Cartesianism in the Dutch Republic. In fact, the Cartesian spark in De Raey was ignited by the master himself. As a disciple of the philosopher Descartes (1596-1650) and the physician Henricus Regius (1598

1679), he was in a position to witness the trials and tribulations of Cartesian philosophy. These two were trying to forge a harmonious relationship between the immature metaphysics and physics of Cartesian philosophy and the higher discipline of medicine.

Between 1640 and 1643, a number of formulas were developed during a series of practice disputations that were presided over by Regius as part of his private tutoring sessions. These formulas were intended to create a reversible balance between the three branches of the Cartesian tree: metaphysics, physics and medicine.

The next phase of De Raey's life took place in Leiden, where at the age of twenty-five he graduated in both medicine and philosophy. As a protégé of the Cartesian Adriaan Heereboord, he started offering private tutoring in physics. In that age, physics was seen as a part of philosophy. De Raey's supervisor Heereboord was the only lecturer at the University who sympathized with Cartesianism, so there was not much fertile ground from which to spread this new philosophy.

De Raey conceived a strategy: he combined his Cartesian theses with the classic Aristotelian teachings of observation and experimentation and so managed to sneak it into the philosophy curriculum like a Trojan horse.

Thanks to the practice disputations he put forward in his book *Clavis Philosophiae Naturalis Aristotelico-Cartesiana*, published in 1654, we are able to closely follow how this strategy worked.

In 1658, De Raey was given a teaching assignment at the Faculty of Medicine. He grabbed this opportunity to follow in his tutor Regius' footsteps and apply his adapted Cartesian theory to the study of medicine. Until recently, little was known about this phase of his life, but the discovery of a medical treatise entitled *De Febris* dating from 1659 has shed new light on this period. Under De Raey's supervision, the student Israel Conrat defended various theories about the causes of fevers. His theories offer us a unique insight into De Raey's medical kitchen; it is a fascinating glimpse into the way he attempted to concoct a theory of human physiology out of philosophical ingredients.

The word 'feverish' was often used to explain a disorder of the heat source (the life source) and all the related metabolic functions. In other words, there was often a recognizable medical concept behind the treatment of fevers.

In that same year, Sylvius too presided over his first small class of private students. His student Lodewijk Meyer, later a famous Spinozist, was the first to explain Sylvius' iatrochemical theory.¹ Sylvius organized two practice disputations on fevers during his private classes² in order to fine-tune his concept. There are a number of surprising similarities between the Cartesian and iatrochemical physiologies that suggest a cross pollination of ideas.

The fourth phase of De Raey's career began in 1662. During that year, and against the wishes of the Curators, De Raey stopped providing lectures in medicine and instead continued only to teach physics. In his private classes he mainly discussed pure philosophy. As of this period, he desisted using metaphysics and physics to describe human physiology and other higher faculties of physics, chemistry, biology and the study of medicine in general.

In the following pages I will guide you on an adventure through time with Johannes de Raey, but first I will explain how I went about compiling this work. Before I analyze the medical theory behind Regius' practice disputations and the role of the disputants (and in particular De Raey's role), I will first explain a little more about the philosophy of Descartes, whereby I will focus mainly on those aspects that are pertinent to the analysis of medical theory. I will also properly introduce the second main character who was important in De Raey's education: Henricus Regius. His initiative to conceive a Cartesian theory of medicine, and the near-obsessive manner in which he literally forced his two hundred theses on the established Peripatetic order, were imposing to say the least. In fact, in combination with his complete dedication to Descartes in the early years, he could almost be described as sectarian. Although he would finally turn his back on his master, it is clear that Regius laid down the foundations of Cartesianism in the Netherlands.

Based on the correspondence between Descartes and Regius, we will sketch a picture of the manner in which the budding science of philosophy was used to lay the first building blocks of the science of medicine. The final outcome of this process is evident in the printed theses of the disputations. I have extracted four

¹ Meyer, L., *Disp.secunda de chyli...*(Leiden 1661).

² Goclenius, L., *Disp. prima de febribus...*, (Leiden 1661) Lahr, J. van der, *Disp.secunda de febribus* (Leiden 1663).

Aristotle, as Descartes openly did, was therefore equivalent to atheism.¹³ A clear example of his fear of publishing was his response to a number of Regius' draft disputations. For example,¹⁴ he rejected Regius' option of a tripartite soul¹⁵ by referring to the Roman Catholic Church, which had labelled this a heresy. Although Descartes claimed to believe the same things as Regius, he decided it was safer to assign an autonomous modality to the sensitive and vegetative functions. However, in the final disputations of 1641, he did allow some of Regius' passages that contradicted Aristotle's 'sacrosanct' philosophy. This culminated in a crisis in 1643 whereby Cartesianism was formally banned in Utrecht.¹⁶

Letters of Descartes have been found that span a period from August 1638 to the summer of 1645. The friendship between Regius and Descartes was initiated by one of Descartes' earliest followers, the philosopher Henricus Reneri. At Reneri's insistence, Regius had introduced himself to Descartes in a letter in August 1638. Descartes saw promise in this professor of medicine and, to his surprise, Regius had already implemented a large part of his scientific agenda; Regius had used Descartes' rudimentary physical and metaphysical building blocks to erect a Cartesian *oeconomia animalis*.

As I mentioned earlier, Cartesian medicine was as yet uncharted territory. Although Descartes amended Regius' theses to increase his own influence on medicine, Regius still often failed to make a convincing argument.

It was none other than the young doctor Sylvius, who would later become a figurehead of iatrochemical science, who fiercely criticized Regius' theories about the autogenic thermochemical motor that drove the heart.

In his final disputation on the heart¹⁷, De Raey, who from the 1640s onwards was a faithful disputant and disseminator of Regius' ideas, delivered Descartes' theses while at the same time garnishing the texts with his own opinions.¹⁸

Some of the correspondence between Descartes and Regius has been lost.

¹³ Cohen, *De herschepping van de wereld*, 166.

¹⁴ BC, 64; GR, 352.

¹⁵ Descartes rejected the existence of an *anima triplex* as a trinity comprising an *anima intellectiva*, an *anima sensitiva* and a *vegetativa*.

¹⁶ BC, li.

¹⁷ De Raey, *De morborum signis*, 1641.

¹⁸ GR, letter 81, 352. In the correspondence between Descartes and Regius, De Raey is the only student Descartes mentions by name.

The publicist Clerselier had access to the correspondence that Descartes left behind in Sweden when he passed away. This included letters from Regius to Descartes and drafts of Descartes' letters to Regius.

Descartes' original letters are missing, because Regius refused to hand them over to Clerselier.

3 THE PHILOSOPHY OF DESCARTES

Regius and his disputants were effectively placed under the guardianship of their inspirator and spiritual father Descartes. In the same period that Regius was giving lessons in physiology, Descartes' *Discourse on the Method* had already been published (1637), but his *Principia* (1644) had not. In 1641, Descartes did let Regius read his first draft of the *Meditationes* as well as an older copy of *Le Monde* dating from 1637. The first disputations had already taken place by then.¹⁹

To help the reader understand the Cartesian disputations in Utrecht (and later in Leiden), I will first discuss Descartes' theories of physics and metaphysics. This will take the form of a compendium whereby I will focus on the physical and metaphysical themes that were debated during the disputations.

Metaphysics²⁰

Metaphysics are understood to be those philosophical activities that focus on a priori questions, i.e. the search for answers to abstract questions that cannot be answered based on observations using the senses.

In Cartesian philosophy, metaphysics provided the foundation for the explanation of natural phenomena (physics) and related disciplines such as medicine, biology, ethics, etc. This was diametrically opposed to the Aristotelian theory in which observation was the basis of this knowledge.

Descartes described his theory of mechanical physics in his *Discourse on the Method* (1637) and, more systematically, in his four-volume *Principia Philosophiae* (1644). He based his mechanical physics theory on philosophical (epistemological) grounds. The most important knowledge of the philosopher was that of the 'primary causes' which he called *Principia*. In the first part of his *Principia*, he discussed metaphysics, the principles of human knowledge and, in the second part, the principles of material things. In parts three and four he focused on the various natural phenomena.

¹⁹ BC, xi.

²⁰ Schuurman, *René Descartes' hybride fysica*, 277-278.

4 REGIUS: THE FIRST CARTESIAN PHYSICIAN

In 1638, Henricus Regius (1598-1679) was one of the first lecturers in the Dutch Republic to discuss Descartes' new philosophy during his lectures at the recently established university in Utrecht. Regius had actually only 'converted' to Cartesianism a few years earlier. The two books entitled *Les Météores* and *La Dioptrique* that Descartes had published in 1637 had struck Regius like lightning, but he had in fact already been introduced to Descartes and his ideas earlier on by the philosopher Henricus Reneri, when he was working as town physician in Utrecht.²⁵ Descartes had also revealed hints about his ideas during lessons at the Utrecht Illustrious School (renamed Utrecht University in 1636) in 1635.

Regius was so influenced by the new theories that, while he was rector of the School of Latin in Naarden, he even dared to criticize the theories of Aristotle. This got him immediately removed from his post.

As a practicing physician, Regius was initially mainly interested in Descartes' theory of physics. He went on to develop his own natural philosophy based on the still rudimentary Cartesian laws of physics. He summarized his theory of physics, and to a degree metaphysics, in a chapter entitled 'Physiologia, or Cognito Sanitas' (theory of health). As I mentioned earlier, he probably also used Descartes' 1633 draft of *Le Monde*.²⁶ As a confidant of Descartes, Regius had read this work, and also the first draft of the *Meditationes*.

Regius had been appointed Extraordinary Professor of Theoretical Medicine in 1638 and so worked under the head of that department, Willem van der Straten (1593-1681). Van der Straten had pipped Otto Heurnius (1677-1652) of Leiden to the post by establishing clinical and bedside teaching. Regius was also engaged in non-theoretical matters and, in addition to his compulsory lessons at the *Institutiones Medicae*, he spent plenty of time conducting dissections of humans and experimental physiology on animals. He was the counterpart but also the opposite of Johannes Walaeus and Franciscus de le Boe Sylvius in Leiden. Although they agreed about the existence of a bloodstream as suggested by Harvey, Regius had a conflict with them about the working of the heart.

²⁵ Lindeboom, *Henricus Regius*.

²⁶ BC, xi.

For the curriculum of 1640, Regius had decided to include both his experimental findings on the action of the heart and his new theory of physics in his private lessons and then have his students defend his theses during public disputations. He had written these theses based on the new teachings and submitted these to the rector for his approval. However, the Senate opposed his plan because it feared the reputation of the entire university would be damaged. The Senate had not forgotten that Regius had attacked a number of theses put forward by the student Florentius Schuyf (the later Professor of Medicine in Leiden) in 1639. This doctoral candidate had explained the magnetic action of a lodestone using an Aristotelian concept (in classical scholastic teaching, an occult quality such as magnetism could only be explained empirically).²⁷ This was unacceptable for a Cartesian such as Regius and reason to appoint a Cartesian kindred spirit as Schuyf's opponent in the debate, who discharged his duty with such ferocity that Schuyf's supervisor, the Aristotelian philosopher Arnoldus Senguerdus (1610-1667), had been obliged to come to his student's aid.²⁸ Regius had gone on to mercilessly shoot down both men with his razor-sharp verbal volleys. According to the new theory, all observations had to be called into question and tested against the principles of corpuscular mechanics. It was difficult enough to try to explain everyday observations in this fashion, let alone extraordinary natural phenomena like magnetism. Although the debate was highly entertaining for the students, it amounted to nothing more than a perverse attack on the existing rules of Aristotelian philosophy.²⁹

So, it was not surprising that the Senate instructed the rector Schotanus (1598-1652) to order Regius to choose an alternative subject for the disputation (although he was subsequently allowed to include his controversial theories on the circulatory system in the *Corollaria*, as a kind of try-out).³⁰

The stance of the Utrecht Senate has to be considered in the light of the texts that Schotanus was presented in the manuscript. The Utrecht Senate was well aware of the successful experiments that Sylvius and Walaëus were currently conducting in Leiden, where the bloodstream had come to be accepted as a purely empirical phenomenon during various practice disputations presided over

²⁷ Elsen, *Occulte krachten*, 18-19.

²⁸ Thijssen-Schoute, *Nederlands cartesianisme*, 433

²⁹ Voetius, *Testimonium Academie*.

³⁰ BC, 46.

by Walaeus³¹, and which had helped to make the medical disputation classes in Leiden popular once again.

Although Descartes had accepted the existence of the bloodstream based on these experiments, he found an anti-Aristotelian explanation for it.

Cartesius' influence was clearly visible in Regius' theses and the Senate responded like a bull to a red rag.

Descartes supported Regius both verbally and in writing from the first moment he met him, providing both substantial commentary and strategic advice. That latter advice was sorely needed, because Regius had a volatile character and a tendency to meet all situations feet first. In the case of the manuscript on the action of the heart, Descartes had advised him to act with caution, but he was unable to prevent Regius from publishing his theses prematurely. The Senate was staggered but did not dare to arbitrarily refute Regius' theses without consultation, and so asked the advice of the 'Committee of Mayors and Curators'. Amazingly, this higher authority saw things differently, and Regius was given the green light to defend all the theses in his manuscript. The debate drew a large public, whereby the disputant, Johannes Hayman (a citizen of the province of Zeeland), earned the honor *magna cum laude*.

This illustrated the popularity of the new philosophy and justified the Curators' decision. The new university had matured quickly and, with its bedside teaching and tolerance of Cartesian teaching, had become a clear competitor of the university in Leiden.

However, the 'Utrecht State College' was an orthodox stronghold of theologians, who with their numerical superiority had a very strong influence on Senate policy. Regius understood that, even though he had the support of the Curators, he would need to find other help to deal with the Senate if he was to be granted permission to teach the rest of his theories of physiology in the following curriculum.

Regius had prepared thoroughly, probably spurred on by Descartes. He had congratulated the theologian Gisbertus Voetius in advance for his reappointment

³¹ Drake, R., *Disputatio medica de circulatione naturali. Seu, cordis & sanguinis motu circulari.: Pro cl. Harveio*. Drake had debated on this subject on 4 February 1640, but Walaeus' private tutor group had started months earlier. On 7 July, Ph. van Glarges debated the physiology of the heartbeat in the tenth disputation. In 1638 Walaeus presided over various public practice disputations. There are only records of a single disputation in that year: Franciscus Nansius' *De calculo renum et vesicae*.

as rector in 1641, and in passing requested his permission to teach his theses entitled *Physiologiae*, having already shared the manuscript of these disputations with him at an earlier date. The manuscript contained more than two hundred theses in which he summarized the new theory of physics. Voetius was reasonably accommodating and gave Regius permission to include his definitive theses in the medical curriculum, on condition that he would show them to Voetius in advance.³²

Regius had carefully instructed his tutor group and prepared a number of particularly motivated students to unleash the revolution. These included two students from Zeeland, Hayman and Bruinvisch (it was Hayman who in 1640 had given an excellent defense of the bloodstream theory), and, last but not least, Johannes de Raey, the stoic, somewhat conservative student from Wageningen. Based on the available correspondence between Descartes and Regius from 1639 to 1645, we are able to build a very clear picture of the manner in which Descartes' new philosophy was interpreted by a practicing physician such as Regius. Moreover, as of the 1960s, we have been provided with a new opportunity to analyze the degree to which Regius included the recommendations of Descartes in his disputations; in 1964, three disputations on Health were discovered, followed in later years by disputations on Diseases, Symptoms, Diagnosis, Prognosis, Hygiene and Therapy. We now have access to a total of twelve disputations, of which nine date from 1641 and three from 1643. In addition, several more letters from Descartes to Regius have been found.³³ De Raey defended four of the twelve disputations, including the first and last disputations on, respectively, 17 April 1641 and some time in June 1643.

The two philosophers Bos and Verdoorn republished and annotated many of the disputations by comparing them with the corresponding letters between Descartes and Regius.³⁴

³² Duker, 148; *acta academica*, Utrecht, cod. I, fol. 47.

³³ BC, xiv.

³⁴ Bos, *The correspondence between Descartes and Henricus Regius* (Utrecht 2002, dissertation; supervised by Verdoorn).

Cardiovascular system

Descartes had already described the physiology of the cardiovascular system in the fifth part of his *Discourse on the Method* in 1637. Over the years, however, he had to supplement and modify his theory under pressure from physicians' criticism on the one hand and from newly acquired knowledge of anatomy and physiology on the other. Descartes did not limit himself to metaphysical thinking models but used vivisection as a touchstone to validate his theory. He dissected many animals himself and also visited anatomical and physiological demonstrations performed by others. Despite much criticism, he managed to uphold the vital pillar of his theory of a thermo-corpuscular motor of the blood. Descartes was unconsciously driven towards an eclectic use of his experimental results by his firm belief in his theory, but it amounted to false positive empirical support for his concept.

Descartes' correspondence has enabled us to follow how he evaluated his concept.⁸¹ He was looking for a conclusive thermo-corpuscular explanation for the entire *oeconomia animalis*. The basic elements of his theory were motion and heat. He was convinced that heat processes (he also called them boiling processes) were responsible for the digestion of food into the smallest particles (*corpuscula minima*) and also drove the circulatory system. His search for the 'hotplates' of the body and his explanation of the various boiling processes reveal three separate phases. In the 1630s, he had developed a concept comprising two hotplates: one in the stomach/intestine and the other in the heart. In 1640, he and Regius introduced the liver as a third hotplate, and a year later, under pressure from Sylvius, he did away with a number of what had been essential ingredients of the cardiac boiling process.

Dual boiling process⁸²

Descartes considered the heart to be the main source of heat. He compared the enormous heat generated by the heart with fermentation processes, or the

⁸¹ Glazemaker, Descartes Brieven (Amsterdam 1661).

⁸² The main sources were a number of letters that Descartes wrote to unknown scholars in the years following the publication of his *Discourse on the Method* in 1637 (GR, Letters 52, 53 and 54) and his correspondence with Plempius in 1637 and 1638 (GR, Letters 77-80).

chemical reactions of metals in strong water. The heat released made the blood boil and dilute (rarefaction).⁸³

Descartes did not yet speculate about potential *causal agents* of the boiling process at this stage. However, he did add another dimension to Harvey's theory of the circulatory system: in addition to blood circulation, he described a circulation of fine particles. To explain this, he referred back to the metaphysical fertile soil that was formed by the corpuscles. He assumed that blood contained these building blocks and distributed them throughout the body through the circulatory system. However, the very finest particles were filtered out at the artery terminals: the *arteria carotis*, which transported the blood from the heart through the neck to the brain and produced spirit, while the gastric arteries produced strong water for the stomach (but Descartes also considered mouth water in response to hunger to be an arterial filtration product). All these particles were absorbed by a venous capillary network and returned to the heart through the *vena cava*, and subsequently entered the large arterial circulation via the small circulatory system.⁸⁴ An exception was formed by the particles that were excreted through the pores of the skin through *perspiratio insensibilis*. This was the final phase of these *corpuscula minima* and the termination of their participation in the corpuscular building process.

In the stomach, the filtered strong water functioned as a *ferment* and this is where the second boiling process took place. The *ferment* broke down the compounds of the food and boiled them into chyle. This chyle was absorbed through the veins and transported to the heart for the vital boiling process. As already mentioned, Descartes did not venture to offer a more detailed chemical underpinning of the boiling processes, but he wiped the floor with the chemists⁸⁵, who he described as coarse pseudo-scholars who were completely lacking in expertise.⁸⁶ In his eyes, their three core components (Sulphur, Salt and Mercury) were not much different to the four Elements of the ancient philosophers. Descartes believed that these components differed from each other as much as water, snow and ice. He emphasized that all substances, and hence also the so-called nuclear substances, were composed of the same matter. The smallest particles of matter were distinguished only by their shape.

⁸³ GR, letter 52.

⁸⁴ GR, letter 53, 133.

⁸⁵ He meant the alchemists.

⁸⁶ GR, letter 54, 136.

His reasoning in this transport model for the smallest corpuscles was consistent for all physiological processes. He provided a wintery example to illustrate his theory: He assumed the pores of the skin closed when it was cold, preventing the smallest particles from being released through the skin. These were forced to find an alternative route to a place where they could make themselves useful. Descartes invented a new function, saying that these particles were passed to the stomach, where they transformed into strong water to help ferment the copious meals taken in winter.⁸⁷ He thus devised a flexible transport model that could adapt to different circumstances.

Descartes explained the pathophysiology of this model based on the harmful substances in food. He attributed a vital role to the often thick, oily apron of fat that hangs in front of the intestines (*omentum majus*), to which he assumed these harmful substances were transported and stored. The residues of these harmful substances were transported to the heart⁸⁸, where they disrupted the boiling process and thus the body's heat regulation. This did not only result in hypo- and hyperthermia, but it also led to the production of flawed building blocks for the development of the body.⁸⁹

In his correspondence with Plempius, he explained once more what the effect of the boiling process was on the circulatory system.⁹⁰ His description of the diastole and systole of the heart was based on his own observations during vivisections and anatomical demonstrations, whereby the 'droplet theory' played a vital role. This theory was based on three artifacts of the vivisection process:

1- He noticed during the longitudinal cross-sections that the auricles beat about 2-4 times before the heart moved. He also saw that one or two droplets fell into the heart with every beat of the auricles.

2- He considered the auricles to be the mouths of the *vena cava* and *vena pulmonalis* of the right and left ventricles respectively. He did not consider the *atria cordis*, the chambers from which the auricles projected, to be separate anatomical and physiological units. He called the ventricles 'the heart'. He

⁸⁷ GR, letter 52, 129.

⁸⁸ GR, letter 52, 130.

⁸⁹ The *omentum majus* was full of lymph nodes that absorbed harmful substances from the tissue fluid (the lymph). They disinfected the lymph as much as possible and transported it to the venous system. Although Descartes considered the lymphatic vessels to be veins, he did touch on the functional relationship between lymph and inflammations here.

⁹⁰ GR, letter 78, 333.

mistakenly considered the valves to be venous gateways to the heart that formed a connection between the atria and ventricles (atrioventricular valves).

3- He said there was clear evidence for the phenomenon of simultaneous dilation of the heart (he meant ventricle) and arteries during a heartbeat, which evidence was provided by large open wounds in the heart and vessels. He confirmed his observation by conducting experiments on dogs using bellows: he triggered the heartbeat of the right and left ventricles by inserting a tube into the *vena cava* and *vena pulmonalis* respectively, whereby he observed that the heart and arteries swelled and deflated simultaneously. He had his evidence, but the foundation of this proof was once again artificial.⁹¹

Descartes built his cardiac metaphysics based on these false premises. He said the venous droplets of blood must be the catalyst of the cardiac processes. Although he claimed that his boiling process was purely mechanical rather than chemical, he still looked to chemical reactions to back his idea up. For example, he noted that when you poured a small amount of nitric acid onto a scratch in a steel plate, this produced toxic orange and brown fumes. He also added that when you mixed copper with a few drops of a strong acid such as hydrochloric acid, aqua regia or nitric acid, this produced violent and vibrantly colored reactions.

It is interesting to see how he massaged the results of other vivisection experiments to create a building block for his own theory. The occurrence of contractions in dissected pieces of rabbit, dog or eel heart appeared to undermine his theory. However, Descartes always observed a residue of blood on the pieces of heart each time he watched a dissection. It was a suggestive observation; he exclusively saw contractions occurring nearby these blood residues and so he concluded that it was a natural property of blood to cause muscle fibers to contract. He referred to his own experiments to prove his droplet theory and simultaneously refute the existence of an animal motor of the heart. He swept aside Harvey and Plempius' idea that the heart was driven by the *anima rationalis* based on this observation. It was, after all, impossible to divide the God-given anima into smaller parts, and he also denied the existence of an autonomously operating *anima sensitiva* and *vegetativa*. Descartes firmly rejected Plempius' accusation that his idea of a cardiac boiling process was inspired by the theories of Aristotle. Aristotle had suggested that moisture was

⁹¹ BC, 215.

Epilogue

Descartes was forced by the physician Regius to test his theories against the reality of the anatomy and physiology of the human body. According to his thinking, metaphysics was the touchstone of the study of physics and physics served as a platform to other sciences such as medicine, biology, etc.

Descartes eventually lost his way in a maze of his own creation and this applied both to his chemical and his mechanical explanations of physiology. Chemistry was only in its infancy, and there was a plethora of different opinions about how such fluids as bile, chyle, lymph and chyme worked. Moreover, the anatomy of the organs and their relationships with the fluids was an as yet unexplored field. In short, many of the natural phenomena of the body itself were still a mystery, so that it proved impossible to provide an unambiguous corpuscular mechanical explanation on the basis of the *Principia*.

Regius had formulated his own Cartesian theory of medicine, which Descartes would subsequently completely overhaul with commentary, additions and improvements. The result was a modified model that was mangled into yet another form for the disputations.

Eventually, Regius would choose his own path and turn his back on his master. He developed his own Cartesian variant which his pupil De Raey would later claim could not be called Cartesian.¹²⁰

While studying in Utrecht, De Raey was a witness to the birth of Cartesianism. As a medical student, he was fortunate enough to be deployed by Regius, and indirectly Descartes, to disseminate their revolutionary ideas. He participated in all the Cartesian disputations during Regius' collegiate classes, either as a disputant or an opponent of the various theses. This was the start of a voyage to discover an unknown medical landscape; a serious experiment, with Descartes at the helm. Regius was the shipwright, De Raey learned to steer and adjust the course and also sustain damage to the vessel. He arrived in Leiden a veteran of the sea, but he had not discovered a new medical continent, because the first mate had abandoned ship.

His education and experiences left an indelible impression on De Raey. He was a stranger to absolutism, but he was full of confidence that he would discover a new science of medicine based on the implements of Cartesianism. He had

¹²⁰ De Raey, *Cogitata*, 666.

learned to creatively apply the metaphysical core values of matter and extension to the higher echelons of the study of medicine. He was quick to set the tone in his own dissertation of 1647 under the Leiden professor Adolphus Vorstius (1597-1663). More than twenty years later, this work was still being quoted as the first experiment in iatrochemistry in Leiden. This was the chemistry that Descartes would incorporate in his corpuscular theory as the foundation of life processes and on which Sylvius also based his own iatrochemical concept. De Raey began to develop his own Cartesian variant during his physics lectures. He attributed autonomic properties to Descartes' smallest matter, the *materia subtilis*, which he called the fourth *Praecognitum*.¹²¹ De Raey deployed four *Praecognita* as a more versatile alternative to Descartes' *Principia*.

Until now, we knew nothing of the content of the medical lectures De Raey provided between 1658 and 1662. A practice disputation of 1659 entitled *De Febribus* ('On the Fevers'), found in the British Library, has changed things.¹²² It reveals how De Raey attempted to found a human physiology on his own metaphysical building blocks, but also how essential he thought experimentation was for explaining physiological processes. I will shortly go on to provide a commentary on this disputation, but not before I have shared with you the core of the physical and metaphysical concept developed by De Raey.

¹²¹ *Praecognitum* literally means 'something known or that should be known in order to understand something else' (Merriam-Webster dictionary).

¹²² British Library, manuscript, shelf mark 1185.G4 (55). Also stored in the University Library of Groningen, the National Library of France and the State Library in Berlin.

6 PHYSICS AND METAPHYSICS IN THE EARLY 17TH CENTURY

In order to understand how De Raey was introduced to metaphysical education in Leiden, I will first briefly discuss how philosophy, and metaphysics in particular, were received at Leiden University in the early years. Metaphysics had been a controversial subject in Leiden since its foundation. It was often equated with a concoction of papal philosophers. Although Calvin's theology permitted the study of creation, a strict condition was that no theorizing was permitted about the nature of God. This starting point was in stark contrast with that of metaphysics, in which learned men sought to understand the 'why' of all things, and sometimes did not hesitate to involve the role of God in this.¹²³ It was therefore not surprising that metaphysics was not mentioned anywhere in the *Series Lectionum* during the first decades of the university's existence. In contrast, the study of philosophy was prominent in all the lectures. However, this was no more than a 'made-to-measure' package of philosophy teachings aimed to fit every field of expertise, made possible by the broad basis that the subject of philosophy provided; since the scholastic Middle Ages, subjects as wide-ranging as astrology, mathematics, musicology and physics all came under its safe umbrella. To give some examples: the lawyer Cornelis Grotius, the uncle of Hugo de Groot, taught mathematics and ethics, while the physician Gerard Bontius taught mathematics and astrology.

The concept curriculum that the Huguenot Feugeraeus had put together upon the founding of the university included physics teaching as part of the philosophy course, based on the works of Lucretius, Livius and other classical writers. Physics was not a subject of empirical data, but of authority. It involved the study of works of famous physicists and statements on nature uttered by poets and orators.

But for Leiden's Curators, that idea ultimately turned out to be untenable. Dangers lurked that threatened the very foundations of Calvinism.

The physics of Lucretius was based on the theories of Epicurus and Democritus: atomic and materialistic. Moreover, Lucretius did not believe that God was concerned with the affairs of man. So, the Calvinist school in Leiden did not tolerate these writers in the preparatory phase of the philosophical and

¹²³ Bos en Krop, *Burgersdijk*, 13.

theology student Frederik Lucae, who described him as a true Dutchman: rough-mouthed and averse to all forms of courtesy.¹³⁸

Little of De Raey's own correspondence has been retained; there are only a few letters to his pupil Clauberg¹³⁹ and the letters he published himself in his *Cogitata de Interpretatione*.¹⁴⁰ There is an extremely informative letter to his successor, the Cartesian Wittich, in which he was provided justification for the content of his lectures, disputation and his interpretation of Descartes.¹⁴¹

Most information on De Raey, however, is provided by the minutes of the Senate and the Curators. De Raey enrolled as a medical student in Leiden in June 1643.¹⁴² That was two months after he defended his last disputation, under the supervision of Regius. He had spent the previous three years in Utrecht; the average duration of a course of medical studies.

What was uncustomary, however, was the fact that he held another *practice* disputation under that same *praeses*, Regius, at the end of his studies. It is also remarkable that, after so many years of study under Regius, he did not defend his Master's dissertation under his supervision. In other words, why did his last practice disputation, in which he discussed the symptoms of diseases, not qualify as a *pro gradu* disputation? It may indicate that there was disagreement between the teacher and his by now very experienced student. The fact is, De Raey had to spend another three to four years studying in Leiden before he obtained his doctorate in medicine and philosophy. In 1647, he was awarded a doctorate in medicine under Vorstius and a doctorate in philosophy under Heereboord.¹⁴³

After graduating in 1647, De Raey worked as a tutor of philosophy. He could not have chosen a worse period, because barely a year after his graduation all hell broke loose. He participated as one of the opponents in a philosophical

¹³⁸ Schotel, *De academie*, 235.

¹³⁹ Strazzoni, *On three unpublished letters of De Raey to Clauberg*.

¹⁴⁰ See also BC, 120: correspondence between De Raey and Dozen (a scholar from Bremen), dating from 1649.

¹⁴¹ Raey, J. de, *Cogitata de interpretatione*, 654-661.

¹⁴² Johannes de Raey enrolled in Leiden twice: as a 21-year-old student from the town Wageningen, he was enrolled in the medicine course as 'Gelrus' on 6 October. He reenrolled in March of 1646, at the age of 24, but does not mention for which course of study.

¹⁴³ See *Acta Senatus*, 16 July 1647; *Disputatio medica de arthritide* (see Appendix V); *disputatio philosophica de Igne*.

practice disputation in which anti-Cartesian theses were presented. The auditorium was full of supporters and opponents of the new theory who were all riling to go: both Cartesians and Peripatetics, the supporters of the old Aristotelian school. It degenerated into an ugly scrap, whereby punches were thrown and hair was pulled.¹⁴⁴ The one who lit the fuse in the powder keg was none other than Johannes de Raey, only twenty-five years old and ready for action. He had dared to take on the *praeses* of the disputation, Adam Stuart, the straightforward Scotsman who had been appointed the guardian of Aristotelianism three years earlier. He and the theologians Jacobus Trigland and Jacobus Revius together formed a powerful anti-Cartesian axis. These gentlemen understood that the real culprit was none other than their colleague Adriaan Heereboord, who they were sure had whispered the strategy for attack in his pupil's ear. Heereboord and De Raey were both penalized by the Curators. They were henceforth banned from proclaiming Cartesian theories in either words or writing. De Raey, who was initially cleared of all accusations, was later forbidden to give any more private lessons. These rules were drawn up in black and white and they amounted to a formal ban on Cartesianism in Leiden.

Descartes himself joined the debate, and in 1648 he wrote a letter to Stuart that clearly hoped to find a consensus.¹⁴⁵ However, subtlety was not one of Heereboord's finer points. He continued to propagate Cartesian principles and, in a letter to Revius, boasted that he would pay no heed to the ban. Revius took up his pen and asked the Curators to intervene.¹⁴⁶

The Curators subsequently announced that they were tightening the rules of 1647. Not only did they maintain the ban on mentioning Cartesius' name, but they also prohibited all literature suspected of having a Cartesian leaning. Only the theories of Aristotle were to be taught. De Raey also found he had more and more opponents among his colleagues. He and his colleague in philosophy, the orthodox Scotsman Adam Stuart, became arch-enemies who contested each other in embarrassing confrontations in the presence of their students, who were more than happy to join in and often resorted to fisticuffs to reinforce their arguments. The students were mostly divided into two separate camps: the Dutch who were fans of De Raey, and the Germans who preferred the well-mannered and straightforward Stuart.

¹⁴⁴ Molhuysen, *Bronnen*, III, 15-16.

¹⁴⁵ Verbeek, *The first objections*, 31.

¹⁴⁶ Molhuysen, *Bronnen* 3, 15*; Suringar, *Invloed der cartesiaanse wijsbegeerte*, 157.

It is therefore remarkable that, a few years later and immediately following Descartes' death, the Cartesian De Raey abruptly received permission to provide private tutoring during two days of the week. He was even allowed to provide an address in the main auditorium. All this was permitted under the condition that he would not discuss any 'novelties'. Meanwhile, in 1652, the minutes of the Curators noted that De Raey was safely adhering to the Aristotelian doctrine. In addition, it was noted in passing that he had a large and enthusiastic audience and attracted many students from inside and outside Leiden.

This fact was of great importance to the University and so – no doubt thinking the end always justifies the means – they appointed De Raey to the position of extraordinary professor of philosophy in 1653. His popularity skyrocketed and the Curators rewarded him with 200 florins.

In 1654, De Raey published analects of a number of practice disputations, including the text of his address with the suggestive title *Clavis Philosophiae Naturalis Aristotelico-Cartesiana*. The Curators responded enthusiastically to this fusion of the old and the new and rewarded De Raey with a financial bonus. The fact that, a few weeks later, the gentlemen Curators meekly asked De Raey to remove Descartes' name from the title of his book suggests they were not a very steadfast lot. He was offered money under the table to encourage him to meet their request.

Less than a year later, De Raey and his two colleague philosophers Heereboord and Bornius were once again formally called to account and warned to stop holding Cartesian disputations and lectures. In practice, such directives were becoming more and more symbolic and had little or no practical consequences for the Cartesian sympathizers.

And so it was that, despite this warning, in 1658, in the same year that Sylvius was made a professor of medicine, De Raey was given an extension of his teaching assignment and was appointed *Professor Ordinarius Philosophiae*. In addition, the University also granted his request to teach medicine. He even asked to be appointed a special chair in medicine, but the Curators were not willing to go that far yet. However, he was permitted to teach the *Institutiones Medicae*. The Curators apparently had a lot of faith in De Raey, because he was also given permission to preside over public disputations in medicine. De Raey could now do what he had always wanted to do since his student days in Utrecht: like his teacher Regius, he could deploy medicine as a testing ground for metaphysics. The Curators had little choice at that time, because doctor Johannes

van Horne, who had taught the *Institutiones Medicae* for many years, now declined to continue this appointment.

However, enlisting a Cartesian to provide medical education was really asking for trouble.

After his first lectures, all four of the University's medicine lecturers converged on the Curators' doorstep.

The medical quartet of Vorstius, Van der Linden, Sylvius and Van Horne objected to De Raey's teachings, albeit without mentioning him by name. But their message was clear. They did not want any more interference from professors outside their faculty. But they also opposed the 'new philosophy', as Descartes' theories were called. They stated clearly that they did not refute the value of this new teaching, but also that the new theories had no place in their discipline. They even demanded that students who had converted to this new theory should not be allowed to take the exam in medicine. The four also asked for an annual budget to print the first twenty-five practice disputations. This appeared to be a conciliatory gesture towards the Curators, because the disputations were a very popular part of the study programme and so were good for the promotion of the University. They even undertook to organize the printing themselves; the University would only have to pay the printing costs.

In reality, the whole thing was a farce intended to remove the troublesome but popular De Raey from the picture. De Raey's private lectures had grown only more popular over the years, while the lecturers of the established order were teaching their ideas to four empty lecture halls. This was despite the fact that the students had to pay to attend De Raey's lectures and practice disputations from their own pockets. The four lecturers in medicine must have hoped that free private lectures and free printed versions of their own disputations would help to safeguard their future. But they were to be disappointed.

The Curators approved their proposal and agreed that only medical professors would henceforth be allowed to teach the *Institutiones Medicae*. The budget for the booklets was limited to one 'grand' of folio paper, i.e. eight pages. This rule dated back to the foundation of the University and was now dusted off and applied to the lecturers of medicine.

This amounted to a sorry retreat for the four, because their lecture halls continued to grow ever emptier while De Raey's private classes were packed. To top it all off, it was not De Raey who was summoned to the Curators a few months later, but the four gentlemen themselves. They had not delivered on any of their

promises.¹⁴⁷ The Curators demanded that implementation of the reforms be started immediately and that, before they were printed, the theses must be thoroughly checked for ‘novelties’, corrected where necessary, and reported to them if this was not carried out.

But restoring the old order was much harder than expected, because the students kept coming for De Raey. At their wits’ end, the medical lecturers proposed to appoint one of their number, Van der Linden, to teach the theoretical foundations of medicine and to discharge De Raey from his medical teaching assignment. Van der Linden stressed that medicine should not be based on philosophical speculation, but rather on experience. However, the Curators went back on their decision to remove De Raey and decided to wait a little longer to see how the situation unfolded.

In any case, the timetables of 1659 reveal that De Raey continued to give public lectures in medicine on Wednesdays and Saturdays. Four days of the week, at 11 a.m., Anthonides van der Linden also held lectures. Both lecturers taught the *Institutiones*, but it must have given the four medical lecturers a feeling of déjà vue, because Van der Linden’s lecture hall again remained almost empty. He wanted to stop, but the Curators would not allow it. Instead, Sylvius offered to assume responsibility for the lectures together with Van Horne.

The Curators advised them to establish their course schedule in consultation with De Raey himself.

Once again, they seemed to be adopting a mild stance towards De Raey. However, the most salient point was that Sylvius, a potential opponent, had indicated that he would tolerate De Raey as a medical colleague. This was certainly not to be regarded as a favor to De Raey, but anything was better than leaving De Raey alone to teach theoretical medicine based on Cartesianism. During that same meeting, De Raey was called to account again because he had discussed dangerous principles in his lectures. Following Sylvius’ suggestion, the Curators asked him to discuss other medical subjects instead; subjects with a more physical character. De Raey was willing to do this, but only if they awarded him the title of professor of medicine, however the Curators thought this was too great a risk. In 1661, De Raey was made an ordinary professor of philosophy, so all this opposition had in fact come to nothing. The prohibition on giving private lessons in theoretical medicine was also lifted. Sylvius and Van Horne also continued to provide their own lectures on the same subject. In the

¹⁴⁷ Molhuysen, *Bronnen* 3, 152.

meantime, Van der Linden had been removed and was now involved in the clinical education programme.

De Raey continued to teach and conduct disputations in medicine until the end of 1662, when he decided to stop of his own accord. He did continue to teach physics and lectured on this subject until the end of his career in Leiden. However, he never again discussed any other aspect of philosophy during his public lessons, including metaphysics. That subject was reserved for his colleagues: first his teacher Heereboord, later Alexander Stuart, and then Stuart's son David. He was accepted by most members of the Senate. In fact, in 1667, he and Sylvius were even asked to join the Board of the Senate as assessors, a position that formed a potential steppingstone to nothing less than the rectorate of the Academy.

The theologians Johannes Cocceius and his successor Friedrich Spanheim were sworn enemies of De Raey. In the voluminous books they wrote, they described De Raey as an unguided missile who had a sharp tongue during public disputations¹⁴⁸, made provocative remarks and used uncivilized language. In contrast, in one of his published *Epistolae*, Heereboord characterized him as an intelligent and reliable colleague.¹⁴⁹ I would like to share a few excerpts from his *Epistolae* with you now:

In one of De Raey's first performances as an opponent, Descartes was accused of blasphemy.

It was one of the Peripatetics favorite characterizations of Descartes and was provocatively formulated as the thesis of a disputation in 1647.¹⁵⁰ De Raey gave the disputant such a tough time that the orthodox *praeses* Adam Stuart felt bound to silence De Raey with the words: 'Shut up, I don't want to listen to you!'¹⁵¹

¹⁴⁸ Spanheim, *Epistolae*, 66; Coccejus, *Opera anecdotata*, 792.

¹⁴⁹ Heereboord, *Epistolae*, 18.

¹⁵⁰ Thijssen-Schoute, *Nederlands cartesianisme*, 103. Practice disputation presided over by Adam Stuart on 23 December 1647. The thesis was: *inveniuntur ...nonnulli Philosophi, qui certam omnem fidem sensibus abrogant,... Deum negare et de ejus existentia dubitare posse contendunt...* De Raey asked who those philosophers were. The respondent replied that no names could be mentioned, upon which De Raey asked if he meant Descartes. De Raey then recalled a disputation that had been held under Heereboord in 1643, when it was stated that Descartes was anything but an atheist.

¹⁵¹ Heereboord, *Epistolae* 18, 19.

Years later, the roles were reversed. De Raey had by now grown into an authoritative figure in the Senate. During a Senate meeting in 1665, he dared to introduce the most famous Cartesian statement to the discussion: *de omnibus dubitandum*. Doubt was a Cartesian foundation, but in his thesis he even went so far as to doubt the existence of God: ‘We must doubt all matters, even those about which there is only the slightest reason for doubt. So we must also doubt the existence of our mind and of God.’ Cocceius wrote that he had expressed serious reservations about this thesis. He had emphasized the powerlessness of human will and called the principle of doubt a deceptive medicine.¹⁵² De Raey had been typically rude and snapped at him that he, Cocceius, understood nothing of philosophy whatsoever: ‘*tu ignarus es omnis philosophiae*’.¹⁵³

The impression of a rough diamond abounds and his own image, passed down to us as an engraving, reinforces this qualification. His achievements reveal a remarkable pattern of reprimands, pats on the back and even encouragement. This encouragement came from the Curators in regard to his publications and the extra efforts he made in education that enhanced the University’s reputation. All the warnings he received related to the infiltration of Cartesianism in the University’s education, but the sanctions imposed were never enforced and were instead covered with the cloak of charity. There were good reasons for this contrary behavior of the Curators. De Raey’s lectures were extremely popular and attracted a great many students to the University. This was of the utmost importance at a time when other universities in the Dutch Republic were starting to out-perform Leiden. In Utrecht, for example, clinical teaching under Van der Straten had become popular and was a drawcard for medical students. Moreover, philosophical teaching, and metaphysics in particular, had never been a spearhead at Leiden.

The Curators knew that Cartesianism acted as a magnet to young students. This was why a teacher like De Raey, who took Cartesian theory as his starting point in both philosophy and medicine, was so cherished.

¹⁵² Spanheim, *De novissimis, epistolae*, 55.

¹⁵³ Sepp, *Voetiaanse en coccejaanse hoogleraren*, 219; Tholuck, *Das Akademisch Leben*, 234: Tholuck and Spanheim had a different interpretation and ascribed the aggressive role to Cocceius, but Cocceius himself said De Raey had the aggressive role and left no doubt that it was De Raey who chose to attack him.

His huge popularity is demonstrated by the salary he was offered when he relocated to Amsterdam. His wage of 3000 guilders a year was the absolute maximum that was paid in Amsterdam. It was even more than the medical lecturers, normally among the highest earners, were paid.

hypotheses about their effects could complement, reinforce or even contradict each other. This result was inherent to his pure metaphysical thinking, in which he made no concessions to the total physiological concept, be they positive or negative.

He himself knew best of all that his considerations and hypotheses contained too many heterogeneous building blocks to form a stable scientific foundation. It is therefore unsurprising that, during his inaugural speech in Amsterdam, he condemned all metaphysical research on medicine and even stressed that metaphysics could not be a part of the science of medicine.²¹¹

Developments at home and in the world outside

Following the death of the master, De Raey was the first person in the Dutch Republic to independently develop as a neo-Cartesian. This was in the early 1650s, and from the moment he was awarded a special teaching assignment in medicine (1658), he tried to integrate metaphysical building blocks in human physiology and health education. The fermentation model he developed was based on the motion of particles and heat generation. However, although he himself said that his conclusions were pure hypotheses, he had to admit that experimental evidence and experiences had made an important contribution to the development of his model. De Raey confessed that he had conducted and repeated his experiments many times so as to have no doubt about his observations.

At the time, Leiden was host to a wonderful plethora of chemical experiments. These were performed both in the professors' homes and by the students in their rooms.²¹² The professors conducted experiments with distillation equipment they designed themselves. In the students' rooms, 'simple' boiling experiments were conducted using acids and alkalis. Spectacularly erosive reactions were sometimes the result if pieces of copper, silver or iron were placed in strong acids. Sylvius even set up a complete laboratory in his house.²¹³

²¹¹ De Raey, *Cogitata, oratio inauguralis*, 1692: 'the less theology, law and medicine are connected to a philosophy, the better and true will the philosophy be.' De Pater, *Experimental physics*, 314.

²¹² A work of my own will be published on this subject in the near future.

²¹³ Beukers, *Het laboratorium van Sylvius*, 29-36.

A similar development occurred simultaneously in France, the main instigator of which was Jacques Rohault (1618-1672). This scientist was the son-in-law of Claude Clerselier, who had translated Descartes' works. He organized weekly meetings for scholars and artists in Paris throughout the 1650s. One of these was Christiaan Huygens.²¹⁴ He extended the application of Cartesian elements in higher faculties much further than De Raey. Experiments with magnets, Galilean free fall experiments and particularly the many chemical experiments made Rohault's meetings rather more theatrical than scientific. He did have one condition, however: the experiments had to be evaluated according to the Cartesian rules afterwards.²¹⁵

Rohault repeated experiments that Descartes and his good friend Cornelis van Hooghollandse had conducted in Leiden.²¹⁶ The separation of raw metals, mercury experiments and distillation techniques were all explained based on the theory of corpuscular mechanics.²¹⁷ He did not explain the phenomena primarily on the basis of observations and sought explanations in the latent metaphysical microcosm of form and motion of the *particula* and the subtle primary matter. Just like Descartes, he did not provide a mathematical explanation and nor did he comment on the form or motion of the parts. In practice, this meant that his Cartesian principles were placed in jeopardy, whereby the experiment was considered at least as important as reason. In his textbook, it even formed the basis of his hypotheses.²¹⁸

The Parisian variant of Cartesianism did not differ substantially from that of Leiden, but De Raey did not go to the same extremes as Rohault, who had stretched his Cartesian principles into an empirical version. De Raey used his own *Principia* (his version of Descartes' *Praecognita*) to explain the observations. This meant he had a broader metaphysical foundation on which to base his theories. Using the extra dimensions, he was able to bring all kinds of phenomena such as heat development and motion under the autonomous umbrella of the fourth *Praecognitum*.

As mentioned earlier, he attributed active properties to his fourth *Praecognitum*, the *materia subtilis*, which could change the speed and configuration of the

²¹⁴ Gallica, archive, dbnl, p.526-566: *dagboek van Chr. Huygens 1660-1661*.

²¹⁵ Dobre, *Rohault*, 203.

²¹⁶ NNWB, 594-595.

²¹⁷ Dobre, *Cartesian physics*, 133.

²¹⁸ Rohault, J., *Traité de Physique* (Paris, 1671).

earthly particles. He also added an extra dimension to Descartes' hypothesis that fire was present in the blood from the very beginning and that it was bonded to the blood in the form of an oily fluid.²¹⁹ De Raey suggested that the ferment in glandular juices had an intrinsic ignition mechanism that was capable of igniting fire.

This is a selection of the hypotheses, evaluated on the basis of observations, none of which had any mechanical or mathematical foundation.

Both schools provided a-posteriori explanations of the natural phenomena and both used Descartes' *Principia* for this purpose. However, if they got stuck on this route, Rohault would place the natural phenomenon above metaphysics, while De Raey would play his joker in the form of the fourth *Praecognitum*. It clearly exposes the gaps in the Cartesian concept.

The French theory worked better than the Leiden version, because in a stalemate the experiment will dominate. A good example of how Rohault applied the results of experiments to his Cartesian theories is Toricelli's mercury tube experiment. Rohault repeated this experiment on top of the Notre Dame and the mercury level fell by about four centimeters. It was a huge sensation, because this could mean nothing other than that air pressure changed with altitude. Moreover, this was proof of the existence of a vacuum. However, Rohault did not see this as proof of the existence of a vacuum and it did not lead to an epistemic rift, because Rohault considered Descartes' Principles to be axioms. Plenism was a proven phenomenon and so no vacuum could exist.²²⁰

This meant that the spectacles continued to take place in Paris and other French cities, regardless of the results of the experiments. The meetings could be attended by anyone who was interested in scientific fireworks. In France, these gatherings developed an aura of mystery. They emphasized freedom of thought and the separation of body and mind. In the salons, dialogues were held in (and with) the spirit of Descartes and rituals were performed according to established patterns. It was reminiscent of a sectarian society, in which Descartes may not have been the master carpenter of the universe, but he had risen to replace Him on the throne regardless. Cartesianism became a cult and each gave it his own metaphysical interpretation. It became the touchstone of the subjective (self-

²¹⁹ See p.37: Metabolism:life giving heat.

²²⁰ Mc.Claughlin, *Descartes, experiments, and a first generation cartesian*, Jacques Rohault, 334.

invented) outcome. Analogous to the Cartesian separation of mind and body, a separation was made between the experiments in nature and medicine (and more especially physics) on the one hand, and Cartesian philosophy on the other.

However, the French Cartesians considered experimental physics, with all its non-principal properties such as color, light and pain, to provide a solid foundation for their deductive conclusions, even though Descartes had said that these properties were uncertain. In effect, they gave Descartes a dose of his own medicine, for although he had demanded that all observations must be mathematically substantiated, he himself had never formulated deductive formulas. It turned out to be a useless tool for chemistry (properties of separate parts do not provide information about the total disposition of the body), medicine (incorrect interpretation of the heartbeat) and physics (too many derived properties). However, the Cartesian doubts also produced something else, something that had not occurred in science before with such clarity: It induced a new pattern of thinking involving the critical analysis of the established concepts of the Ancients, but also those of contemporaries.

This practical translation of Descartes' teachings can be regarded as empirical Cartesianism.²²¹ It threatened to evolve into a latent center of opposition to the dogmas of the church and the monarchy too. As a result, Louis XIV issued a decree prohibiting all meetings in *salons cartesiennes*. To make matters worse, the four books by Descartes were banned during the 1663 Inquisition. In search of a more controlled form of scientific research, in 1666 the *Academie des Sciences* was founded at the behest of the King of France. During a transitional phase, a circle of followers formed around one Melchisédech Thévenot (1620-1692). This circle included former visitors to Rohault's meetings such as Huygens and Auzout. The Thévenot home was also visited by Swammerdam and Steno during this period, where they conducted dissections and displayed their anatomical discoveries. There was no room there for the Cartesian theses; however, the spirit of freedom of thought was stronger than ever.

In the Dutch Republic, De Raey did not deviate in any way towards the French empirical theory. He had not one good word to say about French Cartesian empiricism. To Baillet, Descartes' French biographer, he worded it as follows:

²²¹ Roux, *Was there a Cartesian Experimentalism?*, 47.

*'Vita Cartesii res est simplicissima, et Galli eam corrumperent.'*²²² In Leiden, there were no salons and no spiritual sessions as held in Paris and elsewhere in France. The 'French separation' of metaphysics from empiricism was not a schism, but a dualistic relationship. De Raey only accepted the metaphysical version and ruled out the experimental variant for good, as we will discuss in the next chapter.

In Leiden, others would continue along De Raey's path. It was popular among physicians to be called a Cartesian, as we noted in Bartholin's correspondence. Even someone like Anthonides van der Linden, who had promoted Aristotelian ideas in his writings and private lectures, was known as Cartesian.²²³

A number of Leiden Cartesians left their mark on medical, physical and biological research. This was the trio of Schuyt, Craanen and De Volder, and to some extent also Sylvius. De Volder and Craanen cited Descartes in their works and lectures until into the 1690s and continued work on Descartes' particles theory. This happened in the same period that scholars in France like Francois André²²⁴ and Nicolas Lemery²²⁵ were developing towards a corpuscular physiology. They hypothesized endlessly on the theme of particles and attributed steering characteristics to the spirit. Earlier, we discussed the Cartesian Pierre Silvain, a student of Rohault. He declared that fire was created when solid particles that were bonded by subtle matter were separated.²²⁶ Like De Raey, he attributed an autonomous property to subtle matter as the regulator of heat. Endless hypotheses were set out on the theme of particles, whereby the ethereal substance was attributed varying degrees of influence.

Although the Curators in Leiden had formally blacklisted Cartesian teaching, there was little evidence of this in the medical writings and lectures of the time. While in France the ecclesiastical and secular authorities under Louis XIV feared their power would be undermined, this was much less the case in the Dutch Republic.

There are a number of important reasons for this. Unlike in France, Descartes' philosophy was not fanatically propagated as a kind of religion in Leiden. In fact,

²²² Baillet, *la vie de monsieur Descartes*, 30.; Thijssen-Schoute, *Nederlands cartesianisme*, 137.

²²³ See his many practice disputations on the influence of Hippocrates, Galenus and Aristotle.

²²⁴ Andre, F., *Entretiens sur l'acide et sur l'alkali*.

²²⁵ Lemery, *Cours de chymie contenant la manière de faire les operations*.

²²⁶ Silvain Regis, P., *Système de philosophie*, 1691.

by incorporating Aristotelian, scholastic building blocks, Descartes' teachings were even used (albeit ambivalently) to further the 'good cause' of Aristotelianism. Moreover, many theologians did not see Descartes to be a threat because he had not discussed theology in his philosophical theories. This was why the Peripatetics had difficulty getting a grip on Cartesians like De Raey, and also why there were initially no unresolvable confrontations.

In fact, it was an internal theological struggle in Leiden that heralded the end of tolerance of Descartes' philosophy. The seeds of this battle were sown by the theologian Cocceius, who was brought into the University in 1650 on the recommendation of the Cartesian Heinsius. Heinsius had had a fierce disagreement with Voetius, the fanatical anti-Cartesian, on the theological subject of the sabbatical commandment. The Orthodox 'Voetians' accused Cocceius and his followers of all manner of novel ideas. The States of Holland and West Friesland eventually instructed the warring parties to end their quarrel. The Voetians also referred to Cartesius in their battle against the Cocceians. His, in their eyes heterodox, philosophy was mentioned in the same breath as Cocceius. Moreover, in 1674 the battle turned somewhat political when the Cocceians were accused of being poor Orangists.

Pamphlets with texts like 'Report on the latest Cocceian and Cartesian novelties' were aimed at eradicating both groups.²²⁷

This mounting battle constituted an imminent crisis not only for theology, but also for the church, the state and the university itself. The Curators made a serious attempt to end the conflict under the motto '*aux grands maux, les grandes remèdes*'. A special committee compiled a collection of 'heretical theses' and identified a grand total of twenty-three. These were literally declared 'unmentionable' by the Curators and the Senate.

This remedy had been applied several times over the previous thirty years to stem the rising tide of Cartesianism. In the meantime, however, Cartesian teaching had continued unabated.

In this case it concerned an internal power struggle within the church itself in which Cartesianism played a role. The Cartesian theologian Heidanus responded extremely fiercely and seriously questioned the integrity of the Curators, so that harsh measures could not be avoided. Heidanus was dismissed and all Cartesian supporters were sucked along in his wake.

²²⁷ Bie and Loosjes, *Biografisch woordenboek van protestantse godgeleerden*, 5.

Interestingly, the anti-Cartesians did not consider Cartesian theories of medicine to be threatening or harmful. When the Curators curtailed the development of De Raey's philosophy, they offered to make him a professor of medicine instead. The Cartesian Theodor Craanen had been appointed professor of philosophy and mathematics in Leiden in 1670 but was dismissed in the crisis year of 1673 on suspicion of Cartesianism. However, his dismissal was followed by a wonderful offer to take up the chair of medicine. Craanen was the one who developed the Cartesian *Forma* as the primary property of the parts in medicine.²²⁸ The Curators gave him absolutely free reign. In fact, he was even rewarded with a cash bonus for his publications. The Curators' stance had not changed much in twenty years. De Raey had received a similar bonus for work with clear Cartesian influences. Craanen did not form a threat to the state or the church and vastly increased the popularity of the medical faculty.

On the one hand, the physicians did not want to accept an unadulterated Cartesian doctrine as a metaphysical foundation of medicine, but on the other they gladly adopted parts of his teachings in order to explain various natural phenomena. Cartesianism as a philosophical movement had been dragged down with Cocceianism based on an artificial relationship that was construed between the two.

However, Cartesian theories continued to hold their own in medicine until around 1687. With the introduction of Newton's theory of gravity, Cartesian physics were finally put to rest for good.

Why did De Raey return to pure philosophical metaphysics following his empirical adventure? And why did the French Cartesians continue with an empirical model that placed experimentation and observation above Descartes' metaphysics, and actually inclined even more towards the Peripatetics than to the *Philosophia Nova*?

The reason for this is obvious: Descartes was simply less popular in France. The French had only been able to gain knowledge of his ideas by reading his manuscripts. He had not shown himself much in that country, except for three short visits to Paris.²²⁹ His teachings were therefore much less well known and topical than in the Dutch Republic. The correspondence with Mercennes and

²²⁸ Luyendijk-Elshout, *Oeconomia animalis, pores and particles*, 294-308.

²²⁹ Ariew, Verbeek, *Historical dictionary of Descartes*, 62.

FINAL REMARKS

This is the first part of a historical study of the medical faculty of Leiden.

No complete history of the Leiden medical faculty is available from the establishment of the university in 1575 up until 1800. In 1911, J.E. Kroon described the first years of the medical faculty in his *Bijdragen tot de Geschiedenis van het Geneeskundig onderwijs aan de Leidsche universiteit 1575-1625* ('Contributions to the History of Medical Education at Leiden University 1575-1625'). Suringar has described the medical events of the 17th and 18th centuries in a multitude of articles. The *Nederlandsch Tijdschrift voor Geneeskunde* (Dutch Journal of Medicine) served as a refugium for this in the previous century. Medical historians were able to publish their articles there, some of which were collected in the *Opuscula Selecta Neerlandicorum*.

For several decades after the war H.J. Witkam published corpus analyses on the medical faculty, the library, anatomical demonstrations and other 'everyday medical matters'. A. Lindeboom made an important contribution with his studies on Boerhaave. His *Analecta Boerhaaviana* is the standard work on the greatest celebrity in Leiden's medical history.

A. Schierbeek, M.A. van Andel, F.M.G. de Feyfer, J.G. de Lint, J.A.J. Barge, J. Dankmeyer, the first professor of medical history in Leiden, A.M. Luyendijk-Elshout, and her successor H. Beukers all published studies on various aspects of medicine in the 17th and 18th centuries.

The general histories of the university written by Mathijs Siegenbeek, and more recently by Willem Otterspeer, often include detailed information of the faculty of medicine.

However, a total historical overview of the first two centuries of the medical faculty in Leiden has never been published.

It is my intention to publish a number of medical studies in the near future. These are all based on draft versions that I have been working on over the years. These will be made available in digital form on the website *ex libris hendrik punt.nl* (<https://elhp.nl>). A number of them will be published in book form in the Dutch and English languages.

I am fortunate to have been able to spend my free time on these studies next to my work as an eye surgeon. My own extensive medical history library served as

my place of work and enabled me to pick up the thread (the book) at any given moment.

These are studies of extraordinary books, but also of medical disputations and practice disputations. The practice disputations indicate the course the faculty took during the period from its establishment until 1700. Studies produced by ‘obscure’ figures such as the deaf 17th-century surgeon professor Adriaan Falcoburgius also shed new light on the medical developments in Leiden.

I will also include a new study of the anatomy of B.S. Albinus.

The printing discipline will also be receiving attention: books by the publisher Plantyn and his son-in-law Raphelengius, a professor of Hebrew who was also printer, woodcuts by Titian and etchings by de Lairese, allegorical representations on title pages of theses, images of professors by famous etchers such as Hendrik Goltzius and Rembrandt, brocade editions, poetic odes and epigrams to PhD students, and beautifully printed eulogies are often underexposed works in medical circles, and I hope to publish and discuss them all in this digital portal.

I will also make room for Excel files containing specifications of the medical disputations.

The Digital Portal makes it possible to include comments on and improvements of digitally published work.

This is one of the blessings of the new digital era and makes publications like this one accessible to anyone interested in Leiden’s medical history. Moreover, digital space is unlimited...

The Portal also aims to be a platform for anyone who has questions or comments about topics relating to medical history in general and the medical faculty of Leiden in particular.

We are always glad to receive information about the location of medical disputations and practice disputations. I estimate that less than 10% of all existing medical practice disputations have been found to date. It is of great importance to academia that such seemingly ‘obscure’ practice disputations are identified and extensively studied. A foundation will be established to provide the necessary funding in order to encourage research into as-yet undiscovered medical sources.

Hendrik Punt

BIOGRAPHY AUTHOR

In addition to his profession as a military physician, the author was also a member of the academic staff of the History of Medicine research group in Leiden during the 1980s.

He focused his work there on anatomy and physiology in Leiden in the 18th century. He also wrote an overview of developments in twenty-five years of medicine together with the then head of the research group, the late Prof. A.M. Luyendijk-Elshout.

In 1983, he published a standard work on the anatomist Bernard Siegfried Albinus (1697-1770), whereby he used 'forgotten' anatomical and physiological sources. These were old lecture notes and anatomical preliminary studies.

During the last two decades he has worked as an eye surgeon at the Military Hospital in Utrecht and later at the University Medical Center Utrecht.

He is currently co-owner and medical director of Eyescan, an ophthalmic healthcare clinic.

Throughout this time, he did not lose his interest in Leiden's medical history. He brought together an extensive collection of Leiden's medical publications, including anatomical atlases, anatomical and physiological books, disputations, practice disputations, inaugural speeches, manuscripts, prints, portraits and instruments. He translated and annotated a large part of these publications himself.

During this period, he became increasingly interested in the content of the disputations, and in particular the disputations *exercitii gratia*. These were public practice disputations on subjects that the lecturer had taught during his private tutorials (*collegia*). They often involved controversial opinions and new ideas put forward by the professors, as well as commentaries on current medical theories. One can imagine how movements such as humanism, Cartesianism and iatrochemistry caused quite a bit of unrest at the new Calvinist university in Leiden, where the classical teachings of Aristotle had been made compulsory. These disputations were often a platform for new scientific ideas.

As less than ten percent of these practice disputations have been preserved and few of the remaining editions have been annotated, we can safely say that an important part of this medical history is lacking.

The author hopes to track down as many of these practice disputations as possible, to annotate them and to give them their proper place in history.