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This is the author's manuscript

Original Citation:

Availability:

This version is available <http://hdl.handle.net/2318/1908836> since 2023-10-13T14:25:46Z

Published version:

DOI:10.1162/posc_a_00587

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The Use and Plagiarism of Descartes's *Traité de l'homme* by Henricus Regius: A Reassessment

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Abstract

In this article I discuss a particular aspect in the Dutch reception of the ideas of René Descartes, namely the use of his *Traité de l'homme* by Henricus Regius. I analyse the use that Regius made of the theory of the movement of muscles, passions, hunger, and more generally of the neurophysiology expounded by Descartes in his book (not printed until 1662–1664). In my analysis, I reconstruct the internal evolution of Regius's neurophysiology, I illustrate its sources beyond Descartes (i.e. Jean Fernel and Santorio Santorio), and I show that he was certainly acquainted with some of its contents as early as in 1641 (when he used it with the mediation of Descartes), before relying on it – as variously discussed in secondary literature – in his *Fundamenta physices* (1646), when he appropriated from it without Descartes's authorization.

Keywords

Henricus Regius – René Descartes – *Traité de l'homme* – locomotion – plagiarism – neurophysiology.

* The research leading to this publication has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 892794 (*READESCARTES*) and, previously, from the Swiss National Science Foundation – SNF, Spark grant number CRSK-1_190670 (*Testing a Multi-Disciplinary Approach to an Unexplored Body of Literature: The Case of Cartesian Dictations*). Special thanks go to Phillip Sloan, Gideon Manning, to two anonymous reviewers, and to the Forschungszentrum Gotha der Universität Erfurt.

1. Introduction

Henricus Regius (1598–1679) had been the first individual who systematically adopted the contents of the *Discours de la méthode* and *Essais* (1637) of René Descartes (1596–1650) for university lectures, using such texts for his teaching of medicine and natural philosophy at Utrecht from 1638 onwards, as well as in his first lengthy series of disputations, the *Physiologia sive Cognitio sanitatis* (1641–1643). However, in 1645 he entered into a quarrel with Descartes over the nature and functioning of the mind, about which Regius held a materialist and ‘radically empiricist’ standpoint (Bellis 2013). Their disagreement also involved the problem of Regius’s originality with respect to Descartes. At the broadest level, Descartes criticized Regius’s subversion, in his *Fundamenta physices* (1646), of the order of presentation and demonstration of the natural-philosophical theories he appropriated from him.¹ More in particular, as Descartes claimed in a series of letters to Andreas Colvius (1594–1671), Marin Mersenne (1588–1648), and Elisabeth of Bohemia (1618–1680), Regius had included in his *Fundamenta physices* a theory of the movement of muscles taken from his still unpublished *Traité de l’homme*, a copy of which Descartes claimed Regius obtained without his consent in 1646, when the printing of his book was almost finished. According to Descartes, Regius misunderstood such a theory, for the reason that he relied on an imperfect and figureless manuscript copy of this treatise, thereby hindering its correct comprehension.

The topic of Regius’s overall originality with respect to Descartes has attracted the attention of historians at least from the publication of the edition of Descartes’s works by Charles Adam and Paul Tannery in 1897–1913, explicitly presenting Regius as a plagiarist of Descartes’s works (AT XI, 672–683). Afterwards, Regius’s ideas have been devoted of a dedicated consideration by Marinus de Vrijer, who in his doctoral dissertation (1917) has shed light on Regius’s philosophical specificity and religious heterodoxy, which became evident during the ‘Naarden affair’ of 1630–1631, well before his acquaintance with Cartesianism (De Vrijer 1917; on Regius studies, see

¹ See, for instance, Descartes to Elisabeth of Bohemia, March 1647: AT IV, 624–628.

Descartes and Regius 2002, *Preface*). Subsequently (1934), Paul Mouy has discussed the contents of Regius's natural philosophy as this was expounded in his *Fundamenta physices* (Mouy 1934, 73–98), a treatise nevertheless appeared only after Descartes's major contribution to natural philosophy, namely his *Principia philosophiae* (1644). It was only the rediscovery of the text of Regius's *Physiologia* by Gianni Micheli (1966) and its discussion by Karl E. Rothschuh (1968) that boosted a renewed interest in Regius's thought, eventually credited with a robust originality with respect to Descartes's. In fact, such series of disputations was prepared by Regius at a time when Descartes had published only his *Discours* and *Essais*, and – according to Rothschuh – without having read Descartes's *L'homme* (Descartes 1966; Rothschuh 1968, 39–66). Later, Paolo Farina has discussed the pre-Cartesian influences on Regius's thought (Farina 1975; Farina 1977; see also Strazzoni 2018), while in the 1980s and 1990s more comprehensive studies have shed light on Regius's overall thought and on its relations with Descartes's. In particular, Theo Verbeek has provided groundbreaking studies on the first phase of cooperation between Descartes and Regius (Verbeek 1988; Verbeek 1992), as well as on the appearance of his *Fundamenta physices*, shedding light on its derivation from Regius's *Physiologia* and Descartes's *Le monde ou Le traité de la lumière* (Verbeek 1994). In turn, Thomas Gariepy has provided a detailed study of the *Physiologia*, claiming that Regius relied on Descartes's *L'homme* for its preparation: a thesis which has been afterwards criticized by Erik-Jan Bos as ultimately unwarranted (Gariepy 1990, 201–204; Descartes and Regius 2002, 81). In more recent years (2017), however, Bos himself has shown, by bringing to the fore a textual similarity between such texts, that Regius's *Physiologia* bears witness of his acquaintance, certainly indirect, of some contents of Descartes's *L'homme* (Bos 2017). Eventually, Tad M. Schmaltz and Annie Bitbol-Hespériès have provided separate discussions of the issue of Regius's uses of Descartes's theory of muscular movement (on which I will be back in a moment; Schmaltz 2016a; Schmaltz 2016b, chapter 5; Bitbol-Hespériès 2019).

To sum up, both Regius's overall debts towards Descartes, as well as his (supposed)

plagiarism of the theory of the movement of muscles have been and are at the centre of increasing consideration. At least on the latter topic, however, no consensus has been reached by historians. In particular, while the fact that Regius borrowed from Descartes's *L'homme* in his *Fundamenta physices* had been established by previous studies, the very extent of such a borrowing, and how and why exactly Regius failed to comprehend the latter text is still subject of debate, as it is the internal evolution of Regius's positions with regard to the muscular movement – from the *Physiologia* to the *Fundamenta physices*. For instance, Verbeek has hypothesized that Regius, having provided in his *Physiologia* an account of muscular movement akin to that later presented in his *Fundamenta physices*, and having relied in the former text on quantitative considerations typical of the approach of his teacher at Padua Santorio Santorio (1561–1636), was probably original, with regard to the theory of muscular movement, both in his *Physiologia* and in his *Fundamenta physices* (Verbeek 1988, 40). In the latter text there was an appropriation of Descartes's *L'homme*, but this can be noticed only in some *errata corrige* appended to it (Verbeek 1994, 542). In turn, Schmaltz – following Mouy – has individuated Regius's misunderstanding of Descartes's text not exactly in what Descartes claimed to be, namely that the animals spirits, responsible for the swelling of muscles and therefore for the movement of animals (viz. what is now labelled as balloon theory, refuted in late seventeenth century by Johannes Swammerdam, 1637–1680: Cobb 2002), cannot move back to the brain via the same channels or tubes of the nerves from which they came from, but rather because Regius's model does not account for the antagonist actions of muscles, in which one muscle is swelled while its opposite or antagonist one is emptied as the animal spirits present in it flow in the first one. Moreover, Schmaltz has identified the cause of such an error in the diagonal or X-shaped disposition of the channels connecting the muscles (Schmaltz 2016a, 77), clearly represented on the extant figures, drawn from Descartes's autographs, published by Florentius Schuyl (1619–1669) and Claude Clerselier (1614–1684) in their editions of *L'homme* (1662 and 1664).² Eventually, Bitbol-Hespériès has argued that one of such autograph figures,

2 Such are Figure 2 and Figure 3 as given in the present paper.

namely the one provided by Clerselier in 1664, is in fact a forgery – actually, not the only Cartesian forgery by Clerselier, who might have even just pretended to be in possession of an autograph of Descartes’s *L’homme* –, and that Regius might have misunderstood Descartes’s theory of the muscular movement for the reason that Descartes himself did not master well a key idea underlying it. Such was the idea of nerve valve, derived from the idea of the *petites portes* regulating blood flow, which Descartes himself did not know well when he prepared his *L’homme*, a text written before his full adhesion to the idea of blood circulation, to which the idea of valve is essential (Bitbol-Hespériès 2019).

Building upon these reconstructions of the issue of the muscular movement, in this paper I provide a reassessment of this famous episode in the Dutch reception of Descartes. In particular, in Section 2 I provide a presentation of the two models of muscular movement preceding the one adopted by Regius in his *Fundamenta physices*, and an overview of the ways in which Regius used Descartes’s texts around 1641, i.e. his *Discours* and *Essais*, as well as his *L’homme*, to which Regius had access through Descartes himself. By relying on *L’homme* neurophysiology, in particular, the idea that animal spirits flows out the pineal gland, Regius adopted a theory of muscular movement predating the one he was to expose in 1646. At the same time, he relied also on the physiology of Jean Fernel (1497–1558), moreover, he probably relied also on the accounts of passions and hunger exposed in his *L’homme*. In turn, in Section 3 I focus on Regius 1646 theory of muscular movement, explaining Descartes’s criticism to Regius and his own theory of muscular movement, to whose comprehension was essential the grasping of the structure of nerve valves, barely conveyed in Descartes’s text (in its different editions). Moreover, notwithstanding the survival of at least one autograph figure of Descartes, such a structure had to be re-imagined by the illustrators of *L’homme* (namely Louis de La Forge, 1632–1666, and Gerard van Gutschoven, 1615–1668) – so that Regius might even have been in possession of a figure by Descartes in devising the model of 1646 (for which he came to rely also on Santorio), though with no help from

it. Moreover, I show that Regius relied even further on Descartes's *L'homme*, especially in those parts he already use in 1641 (i.e. the account of passions and hunger): this suggest a more systematical appropriation by Regius of *L'homme* in 1646, which fell in his hands probably when a part of the text had to be re-printed.

2. Regius's early explanations of muscular movement (1640–1641) and their sources

2.1 Regius's two models

We can identify two different models of muscular movement in Regius's early texts. Model One is used to explain voluntary and automatic respiration in his disputation *Pro circulatione sanguinis* (May 1640), and then in the second disputation of his *Physiologia*, i.e. his *De actionibus naturalibus, Pars posterior* (June 1641). According to Model One, voluntary respiration is determined by a voluntary dilatation of the apertures of the nerves in the brain: this causes animal spirits which are present in the brain to flow into inspiratory or expiratory muscles, thereby dilating them and pulling the lungs to which they are attached. In turn, this causes air to flow in or out lungs in an alternate manner.³ On the other hand, in the case of automatic or natural respiration, the flowing of spirits into the nerves is determined only by a conformation of the meatuses of the brain, from which the nerves themselves originate. In order to explain this process, Regius uses the analogy of the clock. According to the analogy, the continuous movement of animal spirits from the

3 According to Descartes's and Regius's physiologies, animal spirits consist of the subtlest and fastest particles of blood, and are generated through a progressive refinement of the matter of food and its transformation in blood. Besides of dilating muscles, such spirits have the main function of filling and stretching the nerves, and to make possible an uninterrupted communication of movement across them, of which sense perception consist – as I am going to show below. In more traditional physiologies – such as those of Fernel and Santorio, well known by Regius – animal spirits were intended as the carriers of the faculties of the soul. On this topic, see Smith et al. 2012, section 3.

heart to the brain, and then into respiratory muscles is comparable to the transformation of the continuous movement of wheels (caused by a weight or a spring) into the alternate movement of that part “which is vernacularly called ‘restless’.”⁴ In Dutch, this is the *onrust*, and indicates the balancer, a sub-part of a verge escapement system which prevents the weight from simply falling and exhausting all the energy in few moments. This kind of escapement, typical at Regius’s time, consists of a balancer put upon a verge or rod (see Figure 1). The arms of the balancer are moved back and forth thanks to the transmission of movement to the verge by two pallets alternatively hit (from two directions) by the teeth of the second wheel.

On the contrary, according to Model Two, the alternation of movement of muscles is determined at the muscle level only. This model is proposed by Regius in the third disputation of his *Physiologia: De actionibus animalibus, Pars posterior* (30 June/10 July 1641), in the context of the explanation of voluntary movement, but he even extends it to automatic movement. According to his account,

the animal spirits [...], sent into the muscles through the nerves in sufficient quantity by

4 “Respiratio alia voluntaria est, alia naturalis. Voluntaria est, qua anima, nobis volentibus et cogitantibus, principia nervorum, inspiratoriis et expiratoriis musculis insertorum, alternatim aperit, quo spiritus animales in musculos influentes eos secundum latitudinem distendunt, pectusque vicissim dilatant et contrahunt. Respiratio naturalis est illa, quae fit nobis animum non advertentibus (ut ex. gr. in somno), a certa conformatione meatuum, qui sunt in partibus cerebri, a quibus thoracis nervi oriuntur; qua nobis non cogitantibus spiritus animales copiosius influunt, modo in musculos inspiratorios, modo in expiratorios. Nec mira sit illa reciprocatio spiritus per vices ab uno movente contingens; cum mille modis videamus alternas reciprocationes fieri posse in automatis, ab una aliqua vi perpetuo et eodem modo operante: quemadmodum spiritus a corde in ventriculos cerebri continuo et eodem modo influunt. Sic in horologio particula illa, quae vulgo iniquies dicitur, ob solam partium ipsius machinae conformationem, reciprocantur agitationem, etsi spira ferrea, vel appensum pondus semper eodem tenore rotulas moveat,” Regius 1641–1643, 26–27; see also Regius 1640, thesis 10. Unless taken from a translated edition, all the quotations (given in English) from Latin or French primary sources are author’s translations.

means of the pineal gland [*vi glandulae pinealis*], stretch the same [muscles] according to the breadth, [...] contract them according to the length, and therefore the part, in which they are inserted, necessarily moves. The muscle consists of flesh, veins, arteries, a nerve enlarging as a sheath and provided with valves, and a tendon. All these are included in a membrane [which is] like a bladder, so that the animal spirit sent through the nerve, from which it cannot escape, necessarily contracts the muscle by inflating it, and moves the part to which it is attached. However, not all the spirits which are necessary to the movement of muscles are newly supplied by the ventricles of the brain by means of singular alternate movements. Indeed, if this was to happen, the whole brain would necessarily collapse [*conclideret*] in all the swellings of the bigger muscles. Instead, the single pairs of muscles are contiguous in that place where they originate, and they have one common nerve and one valve. Therefore, in all alternations of movements, the animal spirits, variously determined by the soul or by another cause, pass from one muscle to the other one. So that these [spirits], together with few [ones] which flow more newly from the brain, can be sufficient to the performing of all the movements, even the more vehement and quite long-lasting ones. (Regius 1641–1643, 45–46)

This general structure allows that just small amounts of spirits are newly sent by the pineal gland to the muscles via the nerves, when muscles swell. In particular, this is made possible by an anti-reflux valve that always keeps a certain quantity of spirits within the muscles. Therefore, the brain is never completely deprived of spirits, and its ventricles do not droop like sails without wind. This I shall show in more detail below.

2.2 Regius's early, indirect reliance on Descartes's *L'homme* (1641)

What determined the passage from Model One to Model Two (which, as I discuss in Section 4, might have been suggested Regius by Descartes himself)? (1) The idea of the subsidence of the brain (crucial to Regius's understanding of sensations), and (2) the theory that animal spirits flow in the brain out of the pineal gland itself (crucial to his understanding of movement, imagination, and dreaming), both derived from Regius's acquaintance with some contents of Descartes's *L'homme*, from which, moreover, Regius adopted also the account of passions and hunger: an acquaintance was certainly mediated by Descartes himself. In order to appreciate this, we need to ascertain the sources of Regius's early neurophysiology.

First of all, Regius partially relied on Part Five of Descartes's *Discours* in the first disputation of his *Physiologia*, i.e. his *De sanitate, Pars prior* (17/27 April 1641). According to Descartes, animal spirits are to be conceived as a "very subtle wind" generated in the heart as subparts of the blood, from which they detach while moving to the brain, which is connected to the heart by especially straight arteries (i.e. what were usually labelled as carotids, though Descartes does not overtly name them in his *Discours*), so that such spirits, being the fastest particles of blood, can exert their tendency to move according to straight lines and separate from the other particles of blood, in accord with the third law of motion as given in his *Le monde* (AT VI, 54–55; AT XI, 43–44).⁵ In turn, Regius claims that spirits are the most subtle "vapour" of the blood, and exhale into the brain through the pores of the carotid arteries and of the choroid plexus (Regius 1641–1643, 4). The latter was that part of the brain in which, according to the *Physiologia* (1567) of Fernel (a foremost source of Regius for what it concerns the traditional physiology: Strazzoni 2018), animal spirits were generated before filling the ventricles of the brain. According to Fernel, the matter of such spirits is first (1) propelled from the heart to the brain via the carotids, then (2) prepared in the *rete mirabile*, (3) converted into spirits in the plexus; afterwards, (4) the spirits fill

⁵ See also *infra*, n. 10.

the ventricles of the brain and, and eventually (5) is communicated to sense organ and muscles (Fernel 2003, 448). A process omitted by Regius, for whom all the substantial mutations in blood and spirits are nothing but changes in the geometrical features of the particles of food (as suggested him by Descartes himself),⁶ but who keeps the centrality of the choroid plexus as point of exhalation of spirits in the brain. Moreover, he remarks that animal spirits also flow out of the pores of arteries: a point which will be important for the understanding of his reception of *L'homme*, as I show below.

Second, Regius relied on Descartes's essential theory of muscular movement given in Discourse Four of his *Dioptrique*, where he claims that "the spirits [...], flowing through the nerves in the muscles, and swelling them more or less [...] according to the various ways that the brain distributes them, cause movement of all the parts [of the body]" (AT VI, 111). Moreover, Regius could find in Descartes's *Discours* the metaphor of the clock, used by Descartes to convey the idea that the process of blood circulation can be explained just by considering the force, disposition and figure of the parts of the body (AT VI, 50).

In his following disputations, in turn, Regius presented some ideas which reveal that he had access to some contents of Descartes's *L'homme* around 1641, certainly with the mediation of Descartes himself. This kind of thesis has been first claimed by Gariépy, maintaining that as in his *L'homme* Descartes adopted the idea of nerve valve for the first time in a treatise, Regius's use of the same notion reveals that he had read a manuscript of this text (Gariépy 1990, 201–202). This claim is not corroborated by further evidence by Gariépy; nonetheless, the idea of nerve valve is discussed by Descartes in his extant correspondence with Regius, in particular, with regard to the latter's explanation of convulsions or spasms. Though, only in a letter dating between June and October 1641, commenting upon a draft of Regius's *De symptomatis specialibus*, i.e. the fifth disputation of Regius's *Physiologia*, held in November 1641.⁷ Namely a letter probably posterior to

⁶ Descartes to Regius, 24 May 1640: Descartes and Regius 2002, 41–45 (also in AT III, 66–70).

⁷ According to Regius's explanation, partially extant from Descartes's letter, the cause of convulsions is the "density

Regius's *De actionibus animalibus, Pars posterior* (30 June/10 July 1641), where he proposes Model 2 and where idea of valve is employed for the first time by Regius, without prior suggestions by Descartes which are extant to us. Moreover, in such a letter Descartes does not comment upon Regius's explanation of other diseases, like priapism, which in the published text of the disputation Regius explained by the idea of a defect in nerve valves and of the thickness of the animal spirits, doing so – apparently – without Descartes's intervention.⁸ In any case, there is evidence that Descartes – even in the case that he did not suggest him to use Model Two as such – shared with Regius some other contents of his *L'homme*, either in meeting him or in their correspondence.

In particular, Bos has shown the same use of a metaphor in this text and Regius's *De actionibus animalibus, Pars prior* (June 1641) in order to explain the states of wake and sleep (as I clarify in a moment): though, Regius's reliance on the doctrines expounded in Descartes's *L'homme* goes beyond this. This is testified to by Regius's discussion of sense perception, imagination, dreaming, passions, and appetites (viz. hunger), in which he uses the different accounts given by Descartes in his *Dioptrique* and *L'homme*.

By referring to Descartes's *Dioptrique* in his *De actionibus animalibus, Pars prior*, Regius sets out four premises of his theory of perception:

(P1) Nerves are composed by a membrane shaped as a tube, which originates from the two two-fold membrane enveloping the brain, and include subtle filaments (*fibrillae*).

(P2) Once nerves are swollen by spirits, their filaments are “free from every pressure,” and

of the tunics” of nerves. According to Descartes's correction, in turn, convulsions are due to the fact that “certain valves, which exist in the small tubes of the nerves, are opened and closed without order” (Descartes to Regius, between June and October 1641: Descartes and Regius 2002, 81; also in AT III, 459). Descartes's suggested text was hence included by Regius in his *De symptomatis specialibus*: Regius 1641–1643, 92.

8 “Priapismus est diutina colis citra libidinem arrectio. Haec oritur ex eo, quod spiritus animales fungosum penis nervum ex valvularum eius laesione vel spirituum crassitie, affatim impleat, et tetano quodam extendat,” Regius 1641, 85; see also 87.

this enables a transmission of movement from the extremities of nerves to the brain through such filaments.

(P3) In the waking state, the brain is filled by spirits “like a sail swollen by the wind” (*instar veli vento tumidi*).

(P4) Spirits surround the pineal gland in the brain.

Conclusion: once movement is transmitted to the brain from the sense organs (e.g. the eyes) through the filaments, this movement “is impressed” (*imprimitur*) on the spirits surrounding the pineal gland and through them on the gland itself, which is responsible of common sense (Regius 1641–1643, 33–34). So that in his explanation of birthmarks given in the disputation *De actionibus naturalibus, Pars posterior* Regius could claim – by referring to Descartes’s *Dioptrique* – that “the image of a seen or thought object, which is actually depicted in the brain, is carried by means of the animal spirits present in the ventricles of the brain to the pineal gland or conarion”; hence, in his *De actionibus animalibus, Pars posterior* this account is extended the explanation of every kind of sense perception (Regius 1641–1643, 31–32 and 46–47).

Regius could find P1 and P2 in Discourse Four of Descartes’s *Dioptrique*, according to which a nerve is made by three substances: (1) the skin or membrane, which originates from the membranes enveloping the brain and which constitutes the tubes (*tuyaux*) of the nerves; (2) the filaments (*filets*) contained in such tubes, originating from the internal substance of the brain; (3) the animal spirits which flow into the tubes from the brain, and which keep the *filets* free from the pressure of the other parts of the nerve itself, allowing them to transmit a continuous from one extremity to the other one (AT VI, 110–111). As to P4, Descartes is not explicit on it in this text. However, it is logically entailed by what he states in Discourse Five, where he presents his theory of vision in a passage referred to by Regius in his mentioned explanation of birthmark. According to Descartes, the movement caused by light in the eyes is communicated through the *filets* to the “the inner surface of the brain which faces its concavities; and from there it can be carried again to a

certain little gland, which is located in the middle of its concavities, and is properly the seat of common sense” (AT VI, 129). Accordingly, P4 represents an integration of the *Dioptrique* account likely developed on his own by Regius (even if it is explicitly presented also in Descartes’s *L’homme*, in the editions both of Schuyt and Clerselier),⁹ from which Regius draws his conclusion. As noted by Bos, however, the source of P3 was certainly Descartes’s *L’homme* (Bos 2017, 103–104). Indeed, in this treatise the same analogy is used to explain our waking and sleeping states. According to Descartes, the animal spirits entering in the cavities of the brain

have enough force to push the matter that surrounds them outward in all directions, causing it to expand and tighten all the tiny nerve fibres coming from it, in the same way that a moderate wind can fill the sails of a ship and tighten all the ropes to which they are attached. It follows that at such times this machine, being disposed to respond to all the actions of the spirits, represents the body of a man who is awake. Or at least the spirits have enough force to push against and stretch some parts while the others remain [...] relaxed, as happens in various parts of the sail when the wind is too feeble to fill it. And at such times this machine represents the body of a man who is asleep and who has various dreams as he sleeps. (Descartes 2004, 146; also in Descartes 1662, 76–77; Descartes 1664b, 68–69, partially given in Table 1)

⁹ See, for instance, Descartes 1662, 87–88; Descartes 1664b, 77. As to their editions, whose overall variants make advisable to refer to both their texts, see Section 3.1. In the case of relevant variants, I will signal these between parentheses or by quoting both texts; otherwise, the referred or quoted texts do not contain relevant variants; for particularly relevant passages I will provide both versions anyway. Generally speaking, I will provide the French text before the Latin one: since Schuyt provided a translation, I will assume that in those parts not containing variants, otherwise signalled, Clerselier’s version is more faithful to the original. The Adam-Tannery edition is based on Clerselier’s 1677 edition (Clerselier 1677), with minor variants with respect to his 1664 one. I will nonetheless refer to the 1664 edition instead to the AT viz. 1677 one.

Thus far, for Descartes the states of waking and sleeping are determined by the quantity of spirits inflating the ventricles of the brain, exactly like wind swells the sails. Similarly, Regius adopts the metaphor of the sail to exemplify the state of waking, and – consequently – explains sleep as due exactly to the collapse or subsidence (*subsidentia*) of the brain in the disputation *De actionibus animalibus, Pars posterior*. As he puts it,

waking consists of the dilatation of the ventricles of the brain and of the nerves by a sufficient quantity and movement of animal spirits, by which sense organs become free from pressure [so that they can] bring to the soul the movements of the objects [of senses]. [...] Sleep consists of the subsidence of the ventricles of the brain and the nerves, [caused] by a lack [of the] sufficient movement or quantity of animal spirits, by which sense organs stand still, and become unfit to bring to the soul the movements of the objects. (Regius 1641–1643, 41)

Besides by the metaphor that the brain can be inflated or collapse like a sail, however, the access of Regius to some contents of Descartes's *L'homme* can also be proven by looking at Regius's explanation of imagining and dreaming, as presented in his *De actionibus animalibus, Pars posterior*. These work as follows:

imagination is either of awake [people] and it is called fantasy by synecdoche, or of sleepers, and it is called dreaming. Fantasy is the imagination that [...] occurs to the awake man from the movement of the pineal gland, which is moved [...] either spontaneously by the soul, or fortuitously by the carotid arteries enveloping it: and [the

gland] is driven, by means of the animal spirits, towards the traces [*vestigia*] impressed in the brain. [...] Dreaming [...] arises in sleep, when the pineal gland, freed from the subsidence of the brain because of the animal spirits which rise enough copiously in the brain, is driven by the arteries towards its [viz. the brain's] traces. (Regius 1641–1643, 42)

Even if Regius does not detail what are such patterns (*vestigia*) constituting memory, which he just defines as the “retention of the patterns impressed in the brain by the movement of the objects” (Regius 1641–1643, 42) we can ascertain the influence of Descartes’s *L’homme* on this account as it entails the idea that spirits flow in the brain out of the gland (in fact, out of the arteries enveloping it, as for Regius the spirits flow out of the pores of the carotids, as seen above), and that it is this movement that orients the gland towards this or that trace. As to this, Regius’s account comes to match the theory of perception presented by Descartes in his *L’homme*. This is as follows.

First, according to this treatise – as it was in his *Discours* – the strongest parts of the blood “proceed to the [...] brain, inasmuch as the arteries bearing them there are in the most direct line from the heart” (Descartes 2004, 104; also in Descartes 1662, 13; Descartes 1664b, 9). But while in his *Discours* Descartes did not detail what happens next (AT VI, 54–55), in his *L’homme* he maintains that such arteries, after having been dispersed in the *rete mirabile* (more explicitly mentioned in Schuyf’s edition), gather together around the gland, and through their pores the animal spirits are filtered and move into the gland itself (while for Regius they come straightly out of the carotids), and from it into the cavities of the brain.¹⁰ In turn, according to a passage present only in

¹⁰ “Pour ce qui est des parties du sang qui pénétrèrent jusqu’au cerveau, elles n’y servent pas seulement à nourrir et entretenir sa substance, mais principalement aussi à y produire un certain vent très subtil, ou plutôt une flamme très vive et très pure, qu’on nomme les esprits animaux. Car il faut savoir que les artères qui les apportent du cœur, après s’être divisées en une infinité de petites branches, et avoir composé ces petits tissus [in Schuyf’s version: *composuerint admiranda illa reticula*], qui sont étendus comme des tapisseries au fond des concavités du cerveau,

Clerselier's edition, the animal spirits present in the cavities of the brain come both from the arteries which enter in the gland (without a specification whether the spirits pass from the arteries to the gland and then to the brain, or if they issue straightly from the arteries), and from those constituting the *rete mirabile* – respectively, the stronger and weaker spirits.¹¹ Regardless of the version to which Regius had access in 1646 – as in fact before or during 1641 his grasp of ideas typical of *L'homme* was certainly mediated by Descartes (who was to allow transcriptions of his treatise probably only later, as I discuss in Section 3.1, and never complained about an appropriation of it in Regius's *Physiologia*) – what is clear is the centrality of the gland as a source of spirits for both the authors: whether or not with the gland acting as a support for the arteries (as it was, for instance, also in Fernel's physiology),¹² or as a collector of the spirits coming from them.

se rassemblent autour d'une certaine petite glande, située environ le milieu de la substance de ce cerveau, tout à l'entrée de ses concavités, et ont en cet endroit-là un grand nombre de petits trous, par où les plus subtiles parties du sang qu'elles contiennent, se peuvent écouler dans cette glande [...]. D'où il est facile à concevoir, que lorsque les plus grosses montent tout droit vers la superficie extérieure du cerveau, où elles servent de nourriture à sa substance, elles sont cause que les plus petites et les plus agitées se détournent, et entrent toutes en cette glande; qui doit être imaginée comme une source fort abondante, d'où elles coulent en même temps de tous côtés dans les concavités du cerveau; et ainsi sans autre préparation, ni changement, sinon qu'elles sont séparées des plus grossières," Descartes 1664b, 10–12; cf. Descartes 1662a, 14–16. On the *rete mirabile*, see Forrester 2002. Descartes discussed the nature of the carotids (connecting the heart with the brain and eventually enveloping the gland) and the *rete mirabile* in his letter to Mersenne of 24 December 1640: AT III, 263–268. Such a letter is consistent with *L'homme* account(s).

11 “Et notez en passant que ces plus faibles parties des esprits, ne viennent pas tant des artères qui s'insèrent dans la glande H, comme de celles qui se divisant en mille branches fort déliées tapissent le fond des concavités du cerveau. Notez aussi qu'elles se peuvent aisément épaissir en pituite [...].” Descartes 1664b, 66; cf. Descartes 1662, 75: “[i]n transitu vero notare licet, particulas spirituum debiliores in pituitam facile condensari.” Commented in Meschini 2016.

12 In the physiology of Fernel, the gland has the function of support the arteries and veins: Fernel 2003, 104. See Lokhorst and Kaitaro 2001, rebuking the claim of Charles Sherrington that for Fernel the pineal gland had the function of regulating the flow of spirits within the brain (Sherrington 1946, 84–85).

Second, according to Descartes a nerve can be conceived as a tube (*tuyau*) containing other smaller tubes: such two kinds of tubes – namely the big *tuyau* and the smaller ones – are made, respectively, of the two kinds of membranes enveloping the brain. In turn, the smaller tubes contains several filaments (*filets*) made of the internal substance of the brain (Descartes 1664b, 15; Descartes 1662, 19–21). Within the brain, therefore, there are not complete nerves, but only hollow interstices in between the filaments constituting the substance of the brain itself, and forming a sort of net or mesh (*maille*). Such interstices can be conceived as tubes opening on the internal surface of the ventricle of the brain, which faces the pineal gland.¹³ When an external object causes a

13 “[...] pour ce qui est des pores du cerveau, ils ne doivent pas être imaginés autrement que comme les intervalles qui se trouvent entre les filets de quelque tissu: car, en effet, tout le cerveau n’est autre chose qu’un tissu composé d’une certaine façon particulière, que je tâcherai ici de vous expliquer. Concevez la superficie [...] qui regarde les concavités [...] comme une résille ou lacis assez épais et pressé, dont toutes les mailles [in Schuyt’s version: [*cuius singula filamenta*] sont autant de petits tuyaux par où les esprits animaux peuvent entrer, et qui regardant toujours vers la glande H, d’où sortent ces esprits, se peuvent facilement tourner ça et là vers divers points de cette glande [...], et pensez que de chaque partie de ce réseuil il sort plusieurs filets fort déliés dont les uns sont ordinairement plus longs que les autres; et qu’après que ces filets se sont diversement entrelacés [...], le plus longs descendent [...] puis de là composant la moelle des nerfs se vont épandre par tous les membres,” Descartes 1664b, 62–64; cf.

Descartes 1662, 73. Such a passage can, in fact, also be interpreted as meaning that the filaments (*filets*) constituting the brain are the very tubes (*tuyaux*) in which the animal spirits, flow, as Descartes labels the latter as meshes (*mailles*). This problem was discussed by Johannes de Raey, who, evidently having at his disposal a French copy, criticized Schuyt’s translation in a conversation with Ole Borch on 22 October 1662, and also shared his criticism with Schuyt himself. According to a diary entry of Borch, De Raey criticized in particular Schuyt’s translation of ‘maille’ with ‘funiculus’ (‘filament’, ‘rope’), which should have been rather translated with ‘intervallum’ (‘opening’ or ‘pore’). This was the cause, for De Raey, of Schuyt’s belief that the filaments (*fibrillae*) of the brain were hollow, against Descartes’s tenet that such filaments are solid and not hollow, and that between them there are hollow interstices, i.e. the ‘mailles’: “inter colloquia narravit D. de Ræi in Scylij versione Cartesianâ de homine ne unum folium esse sine labe, namqve Scylium non intellexisse ita præcisè Gallica, e.g. mallie, qvòd esset reddendum, intervalla, reddidisse per funiculos, adeoqve statuere fibrillas cerebri esse cavas, contra mentem Cartesij, qvi vult fibrillas cerebri esse solidas, interstitia a. inter fibrillas, ille vocat mallie, i.e. intervalla cava,” Borch 1983, vol. 2,

movement in the filaments, these cause the openings on the ventricle surface to dilate. Such a dilatation of the openings, in turn, causes an increase of flow of animal spirits springing from the pineal gland towards and into the interstices and the nerves (Descartes 1664b, 72; Descartes 1662, 80–81). But since such spirits issue from the pineal gland itself, they “pull the gland with them a little, and cause it to lean,” thereby giving rise to sense perception (Descartes 2004, 157; also in Descartes 1662, 96–97; Descartes 1664b, 85).

This general account is extended by Descartes to the explanation of memory, imagination and dreaming. As to memory, this consists in the patterns traced in the brain by external objects, namely a persistent condition of dilatation of the interstices between the filaments composing the brain, which is caused by the flowing of the spirits issuing from the gland into such pores. For Descartes, such patterns allow a more easy passage of the spirits issuing from the gland, so that “ideas [...] can be formed again long afterwards without requiring the presence of the objects to which they correspond.” Imagination is nothing but the coexistence of different patterns in the brain, each traced as clearly as the others, so that “the spirits will receive something from the impression of each of them, and this will occur to a greater or lesser degree depending on the

217. In 1664, Schuyf addressed De Raey’s criticisms in a letter to an undisclosed recipient (*Interpretis epistola ad amicum*) opening the second edition of his Latin translation of Descartes’s *L’homme*: in it, he defended his translation of ‘tuyaux’ with ‘tubuli’ (which are hollow) rather than with ‘filamenta’ (which are solid) – a choice criticized by the *amicus*, viz. De Raey, according to the letter –, having checked the occurrences of ‘tuyaux’/‘tuyau’ in copies of Descartes’s *L’homme* belonging to Van Gutschoven and Adriaan Heereboord, both reporting such term, unmistakably meaning a hollow structure: Descartes 1664a, *Epistola*, i–iii (unnumbered). However, Schuyf accepted De Raey’s criticism with regard to the translation of ‘mailles’ with ‘filamenta’, which also Van Gutschoven intended as pores or holes, like De Raey – albeit too late to be included in the 1664 edition of his translation: “[s]cripseram, sed sero, ad typographum, ut, ubi Des-Cartes habet, *Dont tous les mailles*, p. 73 [*sic*], lin. 4, non poneret, per *singula filamenta*, quamvis id recte explicari posset, sed, per *singulos poros*, quod tamen D. Gutshovius accuratius explicandum putat per *singula cancellorum*, sive *retis foramina*,” Descartes 1664a, *Epistola*, iii–iv (italics by Schuyf). See *infra*, n. 22.

various ways in which the parts of the figures match one another.” Eventually, dreaming consist of the same process, with the difference that dreams “depend in part on the unequal force that the spirits can have in issuing from the gland [...], and in part from the impressions that are involved in memory” (Descartes 2004, 150, 156, and 167; also in Descartes 1662, 83–84, 95–96, and 115; Descartes 1664b, 74–75, 84, and 102).

Accordingly, the model of perception given in Descartes’s *L’homme* is not based on the idea of the ‘linear’ pushing of parts of matter from the filaments of the nerves into the gland which he proposed in his *Dioptrique*, which was then used by Regius in the account of sense perception given in his *Physiologia*. Rather, in his *L’homme* Descartes develops a more complex theory based on the idea that animal spirits move from the gland to the filaments, and this movement makes the gland lean towards the patterns of memory traced in the brain. A kind of process at work also in Regius’s model of imagination and dreaming, in which the flow of spirits from the gland moves it, and underlying Model Two, according to which, as seen above, “the animal spirits [are] sent into the muscles through the nerves [...] by means of the pineal gland” (Regius 1641–1643, 45). Also in this case, Regius’s model of movement fits the neurophysiology of Descartes’s *L’homme*, according to which the pineal gland can be conceived as a fountain of spirits which are directed by the gland towards this or that nerve in order to swell the muscles (Descartes 1662, 16 and 100; Descartes 1664b, 12 and 87–88).

Eventually, it is worth remarking further uses of Regius of Descartes’s *L’homme*, in particular, of the related accounts of passions and of the appetite of hunger. As to passions, for Regius these are related to judgments or sensations: so that when we sense or we judge about something which is to be pursued or avoided, the animal spirits – directed either by the widening of the opening of the beginning of nerves in the brain, or by the pineal gland – flow into the nerves to the heart (which Descartes indicated Regius as the proper seat of passions in an extant letter to

him),¹⁴ so that they dilate or shrink it in order for it to send more or less blood and spirits in the parts of the body. In the case of a passion related to a sensation, or *affectus sensitivus*, which is usually related to an appetite to pursue or avoid something as determined by a sensation (*appetitus sensitivus*), this happens as a spontaneous motion.¹⁵ Descartes proposes a similar account, with the difference that in his account of spontaneous or reflex motion – which happens without the intervention of the pineal gland – the beginnings of the nerves in the brain are opened by the *filets*, while for Regius by the spirits when they are moved by a sense reception (i.e. by the filaments of the nerves, in accordance with his overall model of perception).¹⁶ As to such account of passions, as I show in Section 4, Regius was to rely more overtly on Descartes's *L'homme* in his *Fundamenta physices*.

As to hunger (which is a sensation leading to an appetite), this is conceived by both authors as the effect of the action of the acid juice, carried by arteries, on the nerves of the stomach, when the latter is empty and no food can be digested. An explanation alternative, for instance, to that of Fernel (according to which hunger is caused by the fact that the sides of the stomach fall on each other when it is empty: Fernel 2003, 409–411), and based on the chemical account of concoction and blood generation which was suggested by Descartes himself to Regius in 1640, in commenting upon a draft version of the latter's *Pro sanguinis circulatione*, according to which food is converted into chyle by the action of the juices carried by arteries in stomach, which dissolve food itself.¹⁷

14 Descartes to Regius, early May 1641: Descartes and Regius 2002, 64–67 (also in AT III, 371–374).

15 See the text from Regius's *Physiologia* given in Table 1. Some textual similarity between Descartes's *L'homme* and Regius's *Physiologia* later recurring also in his *Fundamenta physices* are underlined.

16 See the text from Descartes's *L'homme* given in Table 1, and, for what it concerns reflex motion, Descartes 1662, 32; Descartes 1664b, 27–28 (commented in Descartes 2004, xxiv–xxv). As evident from the text from Regius's *Fundamenta physices* given in Table 1, Regius was to later specify that animal spirits can dilate this or that nerve in accordance to the features of their motion, as if they are 'keys' with specific features. This fits Descartes's account, to the extent that the movement of the spirits can change their course into this or that nerve.

17 Descartes to Regius, 24 May 1640: Descartes and Regius 2002, 41–45 (also in AT III, 66–70); cf. Regius 1640,

Regius's appropriation of Descartes's theory can be appreciated from the textual comparison between Regius's *Physiologia* (*De actionibus naturalibus, Pars prior*, between late May and early June 1641) and Descartes's *L'homme*, as illustrated in Table 2, where the relevant textual similarities between Regius's *Physiologia* and Descartes's *L'homme* are underlined (and later re-used in i.e. in common with Regius's *Fundamenta physices*). As for the explanation of passions, moreover, also in this case Regius was to expand his relying on Descartes's *L'homme* in his *Fundamenta physices*.

Does all this prove that Regius “had seen a manuscript of the *Treatise on Man*” (Gariépy 1990, 201)? Of course, it does not prove that he had at his disposal a copy of it; though, it corroborates Bos's claim that Descartes shared with Regius some of its contents. This might have happened by letter, or in their meetings. Descartes's letters to Regius are indeed extant only in the form of the drafts available to Clerselier, who (as he himself remarked) neither was provided with Descartes's letters by Regius, nor did Regius allow him to publish his letters to Descartes. Consequently, it could be that these topics were discussed by Descartes and Regius in a now lost part of their correspondence (Descartes 1657–1667, vol. 1, 482; Descartes 1664b, *Preface*, viii–ix, unnumbered). Moreover, they likely met more than once. Indeed, between 19 and 23 August 1638 Descartes wrote to Regius allowing him to visit him together with Henricus Reneri (1593–1639);¹⁸ however, Reneri became ill and they could not meet during the autumn. Later, Descartes allowed Regius to visit him alone, after a request of Regius probably dating to January 1639.¹⁹ In fact, as reported by Ole Borch (1626–1690) in a diary entry of 9 March 1661, after a conversation with Regius's student Johannes de Raey (1620/1622–1702), a *respondens* of the *Physiologia*, “Regius [...] drew from some treatises of Mr. Descartes and from conversations with himself many things

theses 1–2; Regius 1641–1643, 18–19.

18 Descartes to Regius, between 19 and 23 August 1639: Descartes and Regius 2002, 10.

19 Descartes to Regius, early February 1639: Descartes and Regius 2002, 12 (also in AT II, 527).

which scattered in his philosophy.”²⁰ In fact, De Raey, who himself met Descartes and is mentioned by Descartes in his correspondence with Regius,²¹ was in possession or at least read a copy of Descartes’s *L’homme* before its publication by Schuyt, as testified by his criticisms to such a translation, which he made against the original French, being the so far anonymous recipient of Schuyt’s *Epistola ad amicum* opening the 1664 edition of his Latin translation of Descartes *L’homme*, and himself a translator of the treatise.²² A copy which he might have had from Regius himself

20 Borch 1983, vol. 2, 43. See also Descartes to Regius, second half of December 1641: Descartes and Regius 2002, 90–91 (also in AT III, 460–462); Descartes to Regius, between 25 and 31 March 1642: Descartes and Regius 2002, 139 (also in AT III, 486); Henricus Bornius to Pierre Gassendi, 16/26 June 1645: Gassendi 1658, vol. 6, 489–499; Descartes to Mersenne, 5 October 1646: AT IV, 508–513; William Cavendish to John Pell, 27 November/7 December 1646: Pell and Cavendish 2005, 494–496; Elisabeth to Descartes, 11 April 1647: AT IV 628–631.

21 Descartes to Regius, early May 1641: Descartes and Regius 2002, 64–67 (also in AT III, 371–374). See also Strazzoni 2022.

22 See *supra*, n. 13. Notably, shortly before the delivery of the last version of the present paper, it has been announced the discovery, at the Bibliotheca Thysiana at Leiden, of a manuscript of a Latin translation of Descartes’s *L’homme* (*Tractatus de homine a Cartesio*, ms. ATH 1444, 96 pages) by Bos. Unfortunately, the manuscript could not be taken into account during the preparation of the present article: still, it is worth mentioning that De Raey himself (evidently discontent with Schuyt’s translation) prepared a Latin translation of Descartes’s treatise. Indeed, according to the sale catalogue (1723) of the private library of Johann Theodor Schalbruch (1655–1723), friend and colleague of his at Amsterdam, De Raey was the author of a “handwritten evidently new translation” of Descartes’s *L’homme*, which was added to or bound with a copy of the 1664 Latin edition of Schuyt: “Tractatus de homine, latinitate donatus a Flor. Schuyt. Lugd. Bat. 1664. Accessit eiusdem versio plane nova ms. auctore Jo. de Raei,” Wetsten and Wetsten 1723, 121. Even if we cannot assume that De Raey made his translation on the basis of a manuscript and not of Clerselier’s edition, his attitude towards the French appropriation of Descartes (as discussed in Strazzoni 2022), makes probable that he used neither Clerselier’s edition, nor a copy that Clerselier sent to his friend Aernout Huyberts (1633–1716) in 1657 (see *infra*, n. 60) – but copy of his (probably conveying the same text used by his mentor Regius, from whom he might have got it). In fact, I suppose that he made such a translation after 1662: indeed, it was bounded with the 1664 edition of Schuyt’s translation (not to the 1662 one), and, as late as in October 1662, De Raey reported to Borch that Huyberts was the only one who could “properly edit that book” for

or from Adriaan Heereboord (1613–1661), his mentor at Leiden around 1647, who was in possession of a copy (Descartes 1664a, *Epistola*, i–ii; discussed in Meschini 2011). So that he was well aware of Regius’s indebtedness and relations with Descartes.

As an intermediate conclusion, as anticipated above we can hypothesize that Regius passed from Model One to Model Two for two main reasons. First, he had been acquainted with the idea, presented by Descartes’s in his *L’homme*, that in the state of waking the brain has to be kept filled with spirits, which therefore cannot all be directed to the muscles. This might have inspired Regius to use the notion of anti-reflux valve (if this was not suggested him directly by Descartes), and to overcome the idea (central to Model One) that all the movements of spirits take place through the brain itself, and not by means of the pineal gland and by the nerve valves but rather of the conformation of the meatuses of the brain (Regius 1641–1643, 26–27). Second, while in fact in Model One Regius maintained that voluntary respiration is caused by a voluntary opening of the beginnings of nerves by the soul, according to Model Two “the animal spirits [are] sent into the muscles through the nerves [...] by means of the pineal gland” (Regius 1641–1643, 45). A tenet which, for instance, underlies also his account of the passions accompanying judgments.²³

Assuming that the flow of spirits out of the gland is constant, and that only their direction towards this or that nerve changes, the use of idea of valve – in Regius’s hands – grants for their continuous presence in the brain and for their conservation. As to this, it is worth remarking Verbeek’s interpretation of Regius’s appropriation of Descartes’s *L’homme*, with regard to his adoption of the idea of nerve valve in the explanation of muscular movement. For Verbeek, Regius’s use of the idea

which purpose he had dissected 100 brains in one year: “[a]djecit neminem posse librum illum bene edere, excepto Huberto, qui vel 100 cerebra unico anno examinavit in ejus rei gratiam,” Borch 1983, vol. 2, 217. So that probably De Raey ventured in a translation after the failure of the project of Huyberts, which had certainly ended no later than 1666, when, together with the Japanese-German-Dutch polymath Peter Hartzing (1637–1680), another associate of De Raey, went in charge of the reactivation of some mines by the Duke Johann Friedrich of Brunswick-Lüneburg (1625–1679) at St. Andreasberg (Harz). See Stock and Weichert 2020; Strazzoni 2020.

²³ See the text from Regius’s *Physiologia* quoted in Table 1.

of nerve valve in 1641 might have been prompted not by Descartes, but by Regius's relying on the physiology of Santorio, to which was central a quantitative consideration of the idea of insensible perspiration. It was for such an overall quantitative approach that Regius devised such a valve.²⁴ In fact, the idea of insensible perspiration was to play a relevant role in Regius's *Fundamenta physices*, where Regius was going to more robustly rely on Descartes's theory of the movement of muscles, and to introduce, in his 1646 neurophysiology, which I present next, some idea typical of Santorio (as I show in Section 3.4).

3. Regius's explanation of muscular movement in 1646

3.1 Descartes's criticism – and versions of the text

Regius provided his theory of the movement of muscles in chapters ten (*De animalibus*) and twelve (*De homine*), where it is repeated almost verbatim, and in one additional paragraph given in the *Errata* of his *Fundamenta physices*. Upon reading this, Descartes accused Regius of having obtained a copy of his *L'homme* without his consent, and of having improperly copied his theory of muscular movement.²⁵ In particular, in his letter to Colvius of 5 October 1646 Descartes traced Regius's misunderstanding of his theory to the latter's relying on an imperfect and figureless copy,²⁶ while in his letter to Mersenne of 23 November 1646 Descartes claimed that Regius "got hold of my manuscript when the printing of his own work had almost been complete," so that he could

²⁴ Verbeek 1988, 40. On Santorio and Regius, see Farina 1975; Strazzoni 2018.

²⁵ Descartes to Colvius, 5 October 1646: AT IV, 516–519 (see Descartes and Regius); Descartes to Mersenne, 5 October 1646: AT IV, 508–513; Descartes to Mersenne, 23 November 1646: AT IV, 565–568; Descartes to Elisabeth, December 1646: AT IV, 589–591; Descartes to Elisabeth, March 1647: AT IV, 624–628. Moreover, Descartes more publicly distanced himself from the contents of Regius's book in the *Lettre-Préface* to the French edition of his *Principia philosophiae* (1647): AT IX/2, 19–20. See also AT IV, 691.

²⁶ Descartes to Colvius, 5 October 1646: AT IV, 516–519.

draw only the theory of muscular movement from it. As to this, according to Descartes

his way of explaining the movement of the muscles, although this comes from me, and has pleased him so much that he has twice repeated it word for word, it is nevertheless quite worthless, since he has not understood what I wrote and has forgotten the main point. Moreover, he has not seen my diagram, and has drawn his own very badly, in such a way as to contradict the laws of mechanics.²⁷

As Descartes clarified in his letter to Elisabeth of March 1647, Regius

has not understood what he wrote, for he has omitted the main point, namely that the animal spirits which flow from the brain to the muscles cannot return by the same passages through which they came. Without this observation, everything he writes is worthless, and because he did not have my diagram, he produced one that clearly shows his ignorance.²⁸

Accordingly, Descartes attached a great value both to the conditions of Regius's copy (and to the imperfect state of his own treatise),²⁹ as well as to his lacking a figure in understanding his text, leading Regius to misinterpret the "main point" of Descartes's theory of the movement of muscle, and to provide a figure contradicting the rules of mechanics. Therefore, in order to understand Descartes's theory of the movement of muscles and criticism of Regius, we need to consider the

27 Descartes to Mersenne, 23 November 1646: Descartes 1991, 301–302 (also in AT IV, 566–567).

28 Descartes to Elisabeth, March 1647: Descartes 1991, 314 (also in AT IV, 626).

29 See *infra*, n. 25.

different versions of the text and figure which are extant to us.

As mentioned above, Schuyt and Clerselier provided editions with textual variants with respect to each other. Such variants have been presented in the Adam-Tannery edition,³⁰ and discussed, in particular, by Franco A. Meschini. On their basis, however, we cannot establish if they were author's, copyist's, or editor's and translator's variants (Meschini 2011; Meschini 2015; Meschini 2016).

On the one hand, Schuyt had probably access to a version of *L'homme* on which Descartes intervened the last time no later than 1641 or 1642. Indeed, on 23 November 1646 Descartes wrote Mersenne to have allowed a friend of his to make a copy of his imperfect viz. sketched autograph four or five years before (i.e. in 1641 or 1642), and from this copy two other ones were made without having been checked by him, and with no authorization even to show them to anybody.³¹ Probably, the friend mentioned by Descartes was Antonie Studler van Surck (c. 1608–1666), as Schuyt reports in the preface to his edition to have used a copy transcribed by Van Surck from an autograph of Descartes, as well as a copy provided him by Alphonse Pollot (1602–1668).³² There is a certain consensus that Van Surck and Pollot were in possession of two of such authorized copies (Van Otegem 2002, vol. 2, 486–495; Meschini 2011), while the third one probably belonged to Elisabeth, as Descartes reports in letters to her of 6 October 1645 and 31 January 1648 (AT IV, 304–317; AT V, 111–114) that she had seen and read his *L'homme*, while later Urbain Chevreau (1613–1701) reported that she had a copy of it (Chevreau 1697, 101–102; discussed in Matton 2005). So that there is evidence that she was one of the owners of the authorized transcriptions,

30 Considering Schuyt's 1662 edition and Clerselier's 1677 one: AT XI, 209–212. The most part of the variants between these editions recur also between Schuyt's 1662 edition and Clerselier's 1664 one.

31 Descartes to Mersenne, 23 November 1646: AT IV, 565–568. On the imperfect of unfinished character of his *L'homme* see also Descartes to Elisabeth, 6 October 1645: AT IV, 304–317; Descartes to Cavendish, October 1645: AT IV, 325–330; see, moreover, Descartes's 1647 *Lettre-Préface*: AT IX/2, 19–20.

32 Descartes 1662, *Ad lectorem*, xxxii (unnumbered).

moreover, Van Surck and Pollot were her intermediaries with Descartes, and she might have got her copy with their assistance.³³ Accordingly, Schuyl had probably access to copies made not earlier than 1642. In turn, I suspect that Regius probably had a copy coming from Elisabeth, as she was close to Samson Jonsson (1603–1661), until 1644 Anglican court chaplain of her mother Elizabeth Stuart (1596–1662), and, together with Elisabeth, Regius, Heereboord, and others, member of the circle of Samuel Sorbière (1615–1670), a foremost expounder of the ideas of Pierre Gassendi (1592–1655) in the Netherlands (Alexandrescu 2012; Alexandrescu 2013). As testified by Elisabeth himself, Jonsson helped Regius in preparing his *Fundamenta physices*,³⁴ being at some point mistaken for its author by Mersenne,³⁵ and was recipient of a severe reprimand by Constantijn Huygens (1596–1687), directed against Regius’s lack of the due credit to Descartes in his dedicatory letter to the Stadtholder Frederik Hendrik, Prince of Orange (1584–1647), opening the *Fundamenta physices*, of which Regius could not write “even a syllable” without Descartes.³⁶ So that Huygens probably deemed Jonsson as responsible of Regius’s use of Descartes, even in the physiological sections of his book viz. through *L’homme*.

Still, Schuyl might have come in possession of a version of the text, through Van Surck, on which Descartes intervened after 1641–1642, and whose variants with respect to the first version might have been later incorporated by Van Surck on his copy (as suggested in Meschini 2011). However, even if in 1650 he was present at the opening of the trunk of Descartes’s papers left at Leiden before moving to Sweden, we do not know if (1) Van Surck was also the owner of the autograph of *L’homme* after Descartes’s death or departure to Sweden, where he did not bring a

33 See, for instance, Elisabeth to Descartes, 6/16 May 1643: AT III 660–662; Elisabeth to Descartes, 1 July 1643: AT IV, 1–3.

34 Elisabeth to Descartes, 11 April 1647: AT IV, 630.

35 Descartes to Mersenne, 7 September 1646: AT IV 497–501.

36 Huygens to Jonsson, 27 September 1646: The Hague, Koninklijke Bibliotheek, ms. KA 45, 141v, partially transcribed in Huygens 1911–1917, vol. 4, 354.

manuscript of his *L'homme* nor of his *Le monde* (Bortolotti 1987; Van Otegem 2002, vol. 2, 548–549; Descartes 2003, xi–xv), and (2) if afterwards he gave it to Pierre-Hector Chanut (1601–1662). Indeed, Clerselier declared, in the preface to the second volume (1659) of his edition of Descartes's correspondence (1657–1667), to have received a manuscript of *L'homme* from the latter, before labelling it as an autograph in the preface to his 1664 edition (Descartes 1657–1667, vol. 2, *Preface*, xiv, unnumbered; Descartes 1664b, *Preface*, ii–iii). So that we should suppose that Schuyt worked on a pre-1641–1642 version of the text – the same one probably accessed by Regius.

On the other hand, Clerselier provides a more extended and clearer version of the text (as it will be evident in Section 3.2), and at the same time overtly less conservative with respect to the original than Schuyt did. Indeed, in commenting upon his forthcoming edition of *L'homme* in his mentioned 1659 preface, Clerselier reports to be in course of giving to the treatise “all the best form which is possible,” while “amongst other things” the figures were missing, and remarking that “it was to be wished for its final perfection, that its author himself had been able to put the last hand on it” (Descartes 1657–1667, vol. 2, *Preface*, xiv). In turn, in the prefaces to the first and third volumes of Descartes's correspondence he claims to have intervened on the text of the letters, in those cases that some words were unreadable and to soften Descartes's tones (Descartes 1657–1667, vol. 1, *Preface*, vii, unnumbered; vol. 3, *Preface*, xv, unnumbered). So that even if in his 1664 preface he does not mention such kinds of intervention on the text (noticing only to have divided the text in parts and articles), and at the same time remarks the defective character of the text(s) available to Schuyt (which he accessed through Schuyt himself), (Descartes 1664b, *Preface*, ii–v and xxviii), we should suppose that he nonetheless intervened on the text – while Schuyt's text(s) was certainly defective or imperfect (as discussed in Section 3.2). In turn, Schuyt declares, in his 1664 above-mentioned *Epistola ad amicum*, to have pursued a literal translation of the text, also in those cases in which, for him, Descartes should have chosen other words (Descartes 1664a, *Epistola*, iii.). Moreover, some of the variants between Schuyt's 1662 and 1664 editions consist of adaptation of

the Latin to the French text, as exemplified in Table 3, where the relevant texts are signalled in bold. During the preparation of his 1664 edition Schuyt did not access the edition of Clerselier,³⁷ so that we can suppose that he just re-used the manuscripts already in his possession, and that he revised his edition by following them, without even correcting its inconsistencies.³⁸ This suggests that the variants between Schuyt's and Clerselier's editions have to be attributed either to Clerselier or to Descartes's subsequent intervention on the text, rather than to Schuyt.³⁹ In any case, as we cannot ascertain with certainty the source of such variants, we need to consider both the versions – keeping in mind that Regius had more probably access to a text better captured by Schuyt's rather than Clerselier's edition.

3.2 Descartes's figures and theory

As far as the figures are concerned, the first one (Figure 2) originates from an autograph which Schuyt had received from Pollot, together with a diagram representing musical notation, as well as a copy of Descartes's *L'homme*. Such autographs were “roughly sketched by Descartes,” and Schuyt used them to produce engravings included in his 1662 and 1664 editions, where, in particular, the figure representing the nerves (Figure 2) it is labelled as a “figure of the muscle drawn according to

37 In Schuyt's *Epistola ad amicum*, dated 6 March 1664 and written when the book was being printed (as revealed by the letter itself), there is no mention of Clerselier's edition among the copies he consulted to rebuke De Raey's criticisms; moreover, he asked Van Gutschoven to make a check on his copy (coming from Clerselier) without consulting it personally: Descartes 1664a, *Epistola*, ii–iv. Clerselier's edition was published around May at latest, as it appears from a diary entry of Borch of 19 May 1664: see Borch 1983, vol. 3, 408.

38 See Section 3.2, in particular *infra*, n. 52. For a discussion of the variants between Schuyt's editions, which might have come from Heereboord's copy, see Meschini 2011. I suppose that such a copy was related to those of Regius and De Raey, given their relations, i.e. that it conveyed the same text.

39 The above-mentioned discovered Latin translation of *L'homme* (see *supra*, n. 22) will certainly shed more light on this issue.

the autograph of Descartes” (Descartes 1662, *Ad lectorem*, xxxii).⁴⁰ A second rough autograph sketch, or *brouillon*, representing the same structure was allegedly used by Clerselier to draw an engraving (Figure 3) included in his 1664 edition (Descartes 1664b, *Preface*, xv). As mentioned above, indeed, Bitbol-Hespériès has recently questioned its authenticity, suggesting that it might have been a forgery by Clerselier, who around 1658 forged also a letter attributing it to Descartes, before revealing the whole story in 1667 (Belgioioso 2005). In fact, if not a complete forgery by Clerselier, such a figure was certainly an adaptation or “extract” by him (Descartes 1664b, *Preface*, xviii), probably made after the similar figures by Van Gutschoven (Figure 4), which in turn might have been inspired – for what it concerns the diagonal or X-shaped disposition of the tubes connecting the muscles – by the drawing published by Schuyl (Figure 2).⁴¹ In what follows, I will consider such a Figure 3 as a spurious figure, in any case revelatory of the difficulties to grasp the mechanics of Descartes’s account of muscular movement, which was at the centre of his criticism to Regius.

In Figure 2 and Figure 3, D and E depict the two antagonist muscles of the eye, connected to the brain via the nerves bf and cg, and with each other with the diagonal tubes ef and dg. At the upper points of intersection of the connecting channels and the nerves there are two membranes or valves, provided with two flaps (for Clerselier, *replis*; for Schuyl, flaps (*plicae*) or valves (*valvulae*) too) marked (on the left in Figure 2, and on the right in Figure 3), by letters H and i, with the entire membrane or valve being called ‘Hfi’ (or just ‘f’, that denotes also the hole or opening of the tube ef on bf).⁴² This, in Clerselier’s version, is specified acting as a door between the tubes bf and ef – while on the other side there is a corresponding membrane or valve g.⁴³ In this system of tubes, the

40 As to the diagram on musical notation (present, with some imprecision, also in the edition of Clerselier, who does not declare its source), see Bitbol-Hespériès 2019.

41 See *infra*, n. 60.

42 “[...] les deux passages g et f,” Descartes 1664b, 20; cf. Descartes 1662, 23: “[...] ambos meatus G F.”

43 “[V]oyez qu’entre les deux tuyaux bf, e f, il y a une certaine petite peau H fi, qui sépare ces deux tuyaux, et qui leur

animal spirits flow from the brain into the muscles via the nerves bf and cg. Once in the muscles, they cannot exit from them but by moving from one muscle to the other one, or escaping through the flesh, while their quantity is maintained by the coming flow from bf and cg.⁴⁴ In the case of a relaxation of both muscles, the stream of spirits from the brain is weak both in bf and cg: this results in a perpetual, slow circulation of spirits in between D and E, through the diagonal tubes ef and dg, while their valves Hfi (or f) and g are all open.⁴⁵ In the case of a swelling of both the muscles (i.e. when the eye firmly points towards something), the stream is stronger, but equal both in bf and cg.

sert comme de porte, laquelle a deux replis H et i [...]. Et que tout de même entre les deux tuyaux cg, dg, il y a une petite peau ou valvule g, semblable à la précédente,” Descartes 1664b, 18–19; cf. Descartes 1662, 22–23:

“[a]nimadvertendum denique, dari pelliculam quandam H F I quae separet duos tubulos B F et E F quae duas habeat plicas, sive valvulas H I [...]. Pari ratione inter duos tubulos C G et D G quaedam reperitur valvula praecedenti similis.”

44 “Et pensez qu’encore qu’il n’y ait aucun passage évident, par où les esprits contenus dans les deux muscles D et E, en puissent sortir, si ce n’est pour entrer de l’un dans l’autre; toutefois, parce que leurs parties sont fort petites, et même qu’elles se subtilisent sans cesse de plus en plus par la force de leur agitation, il s’en échappe toujours quelquesunes au travers des peaux et des chairs de ces muscles, mais qu’en revanche il y en revient toujours aussi quelques autres par les deux tuyaux bf, cg,” Descartes 1664b, 27–28; cf. Descartes 1662, 22: “[o]bservandum illud etiam est, quamvis nullus evidens meatus appareat, per quem spiritus in duobus musculis D E contenti inde elabantur, nisi per quem ex altero in alterum refluunt; quia tamen eorum particulae, agitatione sua magis magisque attenuantur, quidam per musculorum membranulas, atque parenchyma continuo dilabuntur. Verum identidem quoque deperditorum locum supplent alii per duos tubulos B F et C G eo defluentes.”

45 “[S]i les esprits animaux qui sont dans le cerveau ne tendent point, ou presque point, à couler par les tuyaux bf, cg, les deux petites peaux ou valvules f et g demeurent entr’ouvertes, et ainsi que les deux muscles D et E, sont lâches et sans action; d’autant que les esprits animaux qu’ils contiennent, passent librement de l’un dans l’autre, prenant leur cours d’e par f vers d, et réciproquement de d par g vers e,” Descartes 1664b, 19; cf. Descartes 1662, 23: “si spiritus animales cerebro inexistentes non tendant, aut fere non conentur fluere per tubulos B F et C G duas illas valvulas F et G manere semiapertas sive hiantes: quin etiam duos musculos D E flaccidos omnique actione destitutos fore; quandoquidem spiritus animales in iis contenti ex altero in alterum libere influunt, exorsi ab E per F ad D et reciproce a D per G ad E.”

This leads the spirits moving through bf in D to move into the tube dg, where they evidently impact on the flap twin to i (i.e. the one in the valve marked just by letter g: in Figure 3, on the left), which, acting as a door, closes the tube dg and prevents such spirits to move into E. The same happens in the opposite muscle. So that they both swell.⁴⁶

In the case of the inflation of muscle D only, the stream of spirits from the brain is stronger in bf than in cg: the spirits in bf impact on the valve Hfi, while flaps H and i “are arranged in such a way that when the animal spirits tending downwards from b towards flap H are stronger than those tending upwards from [...] e toward flap i, they push down on and open this membrane [Hfi], thus allowing the animal spirits in muscle E to flow promptly toward D [through ef].”⁴⁷ According to

46 “Mais si les esprits qui sont dans le cerveau tendent à entrer avec quelque force dans les deux tuyaux bf, cg, et que cette force soit égale des deux côtés, ils ferment aussitôt les deux passages g et f, et enflent les deux muscles D et E autant qu’ils peuvent, leur faisant par ce moyen tenir et arrêter l’œil ferme en la situation qu’ils le trouvent,” Descartes 1664b, 19–21; cf. Descartes 1662, 23–24: “[s]i vero spiritus, qui in cerebro sunt contenti, impetu quodam connitantur ingredi duos tubos B F et C G atque iste impetus utrimque sit aequalis, ocludunt e vestigio ambos meatus G F inflantque duos musculos D E quantum id fieri potest. Unde fit, ut sistatur oculus, atque prorsus immotus maneat, eodemque situ, quem primum obtinebat.

47 Descartes 2004, 109–110; also in Descartes 1664b, 18–19: “[...] deux replis H et i, tellement disposés, que lorsque les esprits animaux qui tendent à descendre de b vers H, ont plus de force que ceux qui tendent à monter d’e vers i, ils abaissent et ouvrent cette peau, donnant ainsi moyen à ceux qui sont dans le muscle E, de couler très promptement avec eux vers D. Mais lorsque ceux qui tendent à monter d’e vers i sont plus forts, ou seulement lorsqu’ils sont aussi forts que les autres, ils haussent et ferment cette peau H fi, et ainsi s’empêchent eux-mêmes de sortir hors du muscle E; au lieu que s’ils n’ont pas de part et d’autre assez de force pour la pousser, elle demeure naturellement entr’ouverte”; cf. Descartes 1662, 22–23: “[...] valvulas H I sic dispositas, ut spiritus animales, qui descendere conantur a B versus H si maiorem habeant impetum, quam illi, qui ascendere nituntur ab E versus I deprimant et aperiant hanc valvulam sive pelliculam: adeoque occasionem praebeant illis, qui contenti sunt in musculo E secum promptissime prouendi ad D. Sed cum spiritus illi, qui ab E versus I ascendere nituntur, validiores sunt, aut si solummodo sint aequè validi, quam illi alii, pelliculam sive valvulam H F I, attollunt, clauduntque: atque ita se mutuo impediunt, quo minus exeant ex musculo E: cum alias si utrimque satis virium non habeant, ut per illam transeant, naturaliter aperta maneat.”

Clerselier, who extensively comments on the whole process in his the preface to his 1664 edition – as Descartes’s text “says many things in few words” –, this happens as the spirits push the small hook (*crochet*) visible on flap i (in Figure 3), which initially seemed to be a third flap to Clerselier on the autograph (supposedly) in his possession, thereby contradicting Descartes’s text (at which point, Clerselier not only might have feigned to own an autograph, but also created a sort of narrative around it: Descartes 1664b, *Preface*, xv and xviii). What follows, in fact, is clearer in Clerselier’s than in Schuyt’s edition. According to the former, the spirits close the membrane g and open the membrane f (or Hfi), to such an extent as they act with more or less force.⁴⁸ Namely (if we consider Figure 3) the passage g is closed by the spirits present in D, which pass through dg in the direction of the other muscle: so that they close the flap twin to i in dg by impacting on it. Accordingly, the spirits present in the muscle E move to muscle D through the tube ef (as passage or membrane f is open). In turn, those present in D cannot move towards the other muscle: so that muscle D contracts and the muscle E becomes longer, and the eye is turned towards D.⁴⁹ Moreover, the spirits in D are prevented from returning to the brain through the nerve bf (or to move to the other muscle through the passage ef), because “the flap H can stretch and block their passage,” as such flap acts just as a door.⁵⁰ Accordingly, muscle D is inflated both by the spirits coming from the brain through bd, and by those coming from muscle E. On the contrary, when the eye turns towards

48 “Puis si ces esprits qui viennent du cerveau tendent à couler avec plus de force par bf que par cg, ils ferment la petite peau g, et ouvrent f; et ce plus ou moins, selon qu’ils agissent plus ou moins fort,” Descartes 1664b, 21. As to Regius’s version, see *infra*, n. 52.

49 “[...] les esprits contenus dans le muscle E se vont rendre dans le muscle D, par le canal ef, et ce plus ou moins vite, selon que la peau f est plus ou moins ouverte: si bien que le muscle D, d’où ces esprits ne peuvent sortir, s’accourcit, et E se rallonge; et ainsi l’œil est tourné vers D,” Descartes 1664b, 21. As to Regius’s version, see *infra*, n. 52.

50 Descartes 2004, 111; also in Descartes 1664b, 19: “si quelquefois les esprits contenus dans le muscle D, tendent à en sortir par dfè, ou dfb, le repli H se peut étendre, et leur en boucher le passage”; cf. Descartes 1662, 23: “si aliquando spiritus, contenti in musculo D inde elabi satagunt per D F E aut D F B valvula H distendi potest, atque illis praecludere viam.”

E, f (or Hfi) is closed and g is opened, and the spirits present in D move to E through dg.⁵¹ All this, for Descartes, is made possible by the fact that “these spirits, being like a wind or a very fine flame, must flow promptly from one muscle to another as soon as they find a passage, even though they are propelled by no other power than the inclination that they have to continue their motion in accord with the laws of nature” (Descartes 2004, 112–113; also in Descartes 1662, 24; Descartes 1664b, 21). Namely, this is in accord with the laws of motion as given in his *Le monde* (and then in his *Principia*), which also regulated the detachment of animal spirits from the blood, as seen above.

This is, in short, Descartes’s account of antagonist action of muscles as it emerges especially from Clerselier’s version of the text: Schuyt, indeed, provides a less clear figure (Figure 3, where it is difficult to relate the movement of the two flaps in one valve, and only i resembles a door) and text. Schuyt’s version does not contain the passages according to which, as a consequence of the movement of the membranes, the spirits present in the muscle E move to muscle D through ef, while in the case of a contrary movement they move through dg.⁵² In other words, we do not have an account of the antagonist action of muscles in Schuyt’s version of Descartes’s text, both in his 1662 and 1664 editions, as clear as in Clerselier’s edition – let aside that in any case the text only is not enough to understand Descartes’s explanation.

51 “Comme au contraire, si les esprits qui sont dans le cerveau tendent à couler avec plus de force par cg que par bf, ils ferment la petite peau f, et ouvrent g; en sorte que les esprits du muscle D retournent aussitôt par le canal dg dans le muscle E, qui par ce moyen s’accourcit, et retire l’œil de son côté,” Descartes 1664b, 21. As to Regius’s version, see *infra*, n. 52.

52 “[S]i spiritus ex cerebro prolabentes maiori impetu fluere nitantur per B F quam per C G occludunt pelliculam, sive valvulam G recludunt F; et celerius quidem tardiusve, quatenus ea valvula magis aut minus aperta est: ut musculus D unde hi spiritus egredi nequeunt, contrahatur: E vero extendatur; et proinde oculus vertatur versus D. Sicuti e contra, si spiritus ex cerebro maiori impetu nitantur profluere per C G quam per B F, claudant pelliculam F et aperiant G; ut spiritus musculi D statim redeant in musculum E, fitque adeo, ut hic contrahatur, oculumque ad se trahat,” Descartes 1662, 24; cf. Clerselier’s text quoted *supra*, nn. 48, 49, and 51, and Schuyt’s 1664 edition, with no variants: Descartes 1664a, 24.

Eventually, such a model is applied by Descartes to the explanation of respiration, an automatic movement in which the two muscles D and E have to be conceived as inspiratory and expiratory muscles: in such case, the nerve or tube (named 'n') connecting the brain (m) with tube bf and muscle D is always open, and the spirits coming from the brain through bf open the valve Hfi in such a way that the spirits present in muscle E move towards D via the channel ef. At that point, since respiratory muscles are enveloped in an elastic membrane, this causes D to compress the spirits inflating it, and to push them towards channel n via bf. In a way not clarified by Descartes (probably, just because n is bifurcated into bf and cg), at that point the spirits coming from the brain are moved into cg, and the process re-starts automatically (Descartes 1662, 26–29; Descartes 1664b, 23–25).

3.3 Regius's figures and theory

As to Regius, in his *Fundamenta physices* he follows both Descartes's order of exposition, (namely he accounts for the conditions of relaxation and swelling of both the muscles, then for the swelling of one of them, and eventually – but only in chapter ten – for respiration), and – with some adaptation – his general model of muscular movement. He uses a figure (Figure 5) in which B and C are two antagonist muscles of eye I, DE and FG are two nerves, while D, F, G and E are valves which acts like simple doors. As in Descartes's model, the nerves are connected to each other by two passages (G and E), and are provided with anti-reflux valves D and F, which close when the spirits in one muscle strive to move backwards towards the brain. The swelling of B takes place as follows: if the stream of spirits from the brain (where they issue out of the pineal gland) in DE is stronger than in FG, valve E is closed by the spirits pressing on it, while G remains open. D, in turn, grants that the spirits in B do not reflux towards the brain. All this causes the inflation of B, because the spirits in C move in G as they exert their tendency to move in straight lines in accord with Descartes's third law of motion, and leave the muscles. At the same time, spirits in B cannot move

to C because E is closed (Regius 1646, 222, 224 and 233–235). As to respiration, with his account he replaces Model One,⁵³ as respiration is now explained by following the same account of Descartes – with some differences. Regius claims that the beginnings or pores of the two nerves (considering Figure 5, DE and FG) communicating with respiratory muscles (B and C) are always open in the brain, and one of them is larger and allows the passage of more spirits. Accordingly, one of the muscles (e.g. B) is swelled. As for Descartes, such muscles are enveloped by an elastic membrane, so that when B is swelled, its elastic membrane starts to push the spirits present in it in a way that they open valve G, and through it they move into C, gradually inflating it, until the process reverse (Regius 1646, 235–237). Unlike Descartes’s model, all the process takes place within the muscles, in a way matching Model Two as given in his *Physiologia*, through which (if not directly suggested by Descartes himself too) Regius adapted Descartes’s account.

Even if the similarities are too numerous to exclude the possibility that Regius was unaware of Descartes’s model of muscular movement as given in his *L’homme* while exposing his own in the *Fundamenta physices*, Regius does not explain why spirits just do not move from B to C via G in the main text of his treatise. Accordingly, as put by Schmaltz, Regius’s “diagram suggests that the stronger flow into B leaves G open, and so allows for a flow of spirits into muscle C, thus preventing the disparity that causes the eye to turn toward B” (Schmaltz 2016a, 77), or, according to Mouy, “Regius has not understood [this] at all, and it must be admitted that he had no comprehension of mechanics, which is a serious flaw for a physicist” (Mouy 1934, 89). In fact,

Regius was to correct this in the *Errata* appended to the book, where he adds a paragraph declaring

⁵³ Cf. the text, expounding Model One, quoted *supra*, n. 4, with Regius 1646, 195–196: “[r]espiratio spontanea est illa, quae fit, nobis dormientibus, vel aliter animum non advertentibus, a certa cerebri et nervorum respiratoriorum conformatione, qua spiritus animales, citra nostram cogitationem, modo in inspiratorios, modo in expiratorios musculos fluunt. Qua ratione autem spiritus ab anima determinari, vel sponte in hos vel illos musculos certis vicibus influere eosque movere queant, in doctrina de motu spontaneo et voluntario docebimus.” In other words, in his *Fundamenta physices* Regius overtly refers to the structure of the respiratory nerves, drops the idea that such a process takes place in the meatuses of brain only, and refers to his general account of movement.

that the spirits can move only in one direction in each passage G and E, because such passages are shaped like funnels. Such a paragraph was then included in the main text of the second and third edition of his *Fundamenta physices* (published as *Philosophia naturalis* in 1654 and 1661), where, in the third edition, he also provided a new figure (Figure 6) of the nerve-muscle system including a representation of such passages (Regius 1646, *Errata*; cf. Regius 1654, 323; Regius 1661a, 379–380).⁵⁴ According to him, such a shape enables more easily the passage of spirits in one direction. As to this, he could have in mind a principle which was central to Descartes's dynamics (both of his *Le monde* and *Principia philosophiae*), and which traced back at least to Benedetto Castelli (1578–1643). According to this principle, a fluid passing through a progressively narrowing tube increases its speed, so that it increases its force or momentum (Bertoloni Meli 2006, 84–85 and 157). Accordingly, such a shape increases the force of the spirits moving from C to B with respect to those moving from B to C. Therefore, the spirits move more easily from C to B than vice-versa, as the effect of their increased force due to the mere shape of the tube.

3.4 Descartes's criticism explained

In the light of this account, how is one to make sense of Descartes's criticism of Regius? As discussed above, Regius did not understand the main point of Descartes's account, namely that the spirits cannot return to the brain by the same conduits through which they come, and he provided a figure violating the rules of mechanics, for the reason that he had not seen Descartes's figure. However, as one of Regius's followers was to note probably after the publication of Descartes's letter to Elisabeth of March 1647 by Clerselier, Regius's account of the movement of muscles seems not to fit Descartes's reading. In particular, Regius's overtly adopted the idea of anti-reflux

⁵⁴ Notably, in the 1654 edition Regius added – once again in the *Errata* – new figures of the muscle-nerve system, in which the conditions of opening and closing of the valves are more clearly represented. These figures were, however not included in the 1661 edition.

valves, both in Model Two as well as in the model of 1646, which does not warrant this criticism.⁵⁵ According to Regius's *Fundamenta physices*, the spirits flowing into B through the nerve DE are prevented from moving back to the brain by the anti-reflux valve D (in Figure 5). Similarly, in Descartes's model (see Figure 3), the spirits flowing into muscle D via nerve bf are prevented from leaving the muscle via the same nerve because flap H can stretch and prevent their reflux. Furthermore, in his *Fundamenta physices* Regius expounded a theory of circulation of spirits which decidedly excluded the claim that the spirits return to the brain through the nerves themselves. According to this theory, after having filled the muscles, the spirits move out of their membranes and are expelled partially from the body by insensible perspiration – an idea central to the theories of Santorio –, and partially return to the heart by the veins (Regius 1646, 225–226).⁵⁶ In other words, the use of Santorio by Regius in neurophysiology was concomitant with, or even subsequent to his adoption of Cartesian ideas, and served Regius to explain what happens to muscles once they are filled with spirits. This can be noticed also in Regius's *Fundamenta medica* (1647), namely the medical continuation of his *Fundamenta physices*, and including some text already appeared in his *Physiologia*. In it, Regius partially changed his explanation of priapism, which in 1641 he explained, as seen above, as the effect of a defect of nerve valves or of the thickness of the spirits, while in 1647 he attributed to the thickness of the spirits impeding their insensible transpiration, or to an obstruction of the pores of the prostate by some humours impeding their return through the

55 Namely, a certain Carolus Fabricius from Roermond – who wrote a preface to the second edition (1657, first edition 1648) of Regius's *Brevis explicatio mentis humanae*: Regius 1657, *Carolus Fabricius lectori*, 8–9.

56 Regius provides an empirical demonstration of the theory, consisting of the observation of the behaviour of a slug in water. As soon as the slug moves, bubbles appear on its skin, circularly moving from the head to the tail by the back, and from the tail to the head on the belly. This phenomenon is explained today as an optical effect created by the wave-like undulations of the slug, and is caused – in Regius's model – by the otherwise imperceptible perspiration of spirits from the skin of the slug: Regius 1646, 231–232; see also Regius 1641–1643, 29, as to insensible perspiration. For a discussion, see Clarke 1978.

body.⁵⁷

Still, we can deem Descartes's criticism as properly directed at Regius's model, if we interpret his words – "spirits [...] cannot return by the same conduits from which they came" – as meaning that in Regius's account (viz. in Figure 5), nothing grants that the spirits flowing into muscle C from the brain through FG are forced to pass into B via valve G. This valve, acting as a simple door, does not prevent the spirits pressing on it from B to move into C. In this way, Regius's figure contradicts the rules of mechanics exactly because the spirits flowing into B from the brain have a greater force to continue their movement in straight lines – in accordance with Descartes's third law of motion overtly adopted by Regius in his account – than those flowing into C from the brain. Therefore, nothing accounts for the swelling of B. Admittedly, Descartes's system of valves – as it is extant from his text (in particular, in Schuyl's version) and sketches, both the one provided by Schuyl and the spurious or forged one (in any case an extract) of Clerselier – is not clearer than Regius's. In the figure provided by Clerselier (Figure 3), which is more detailed than that of Schuyl (Figure 2), the representation of the valves nonetheless does not clarify why the spirits moving from the brain through bf into D just do not enter into the passage ef, as they have more force than those moving from E into such a passage, exactly as it happens in Regius's model. In other words, not even such figures are immune to Descartes's criticism. Accordingly, it might be that Regius could have seen one of the figures (autographs or copies) which were going to be used by Schuyl and Clerselier (as supposed in Gariépy 1990, 179), but he could make no more sense of them than we do. In fact, in the common rendering of the valves by the two other illustrators of Clerselier's edition of Descartes's *L'homme* – namely Van Gutschoven (see Figure 4) and La Forge (see Figure

57 Cf. the text quoted *supra*, n. 8, with Regius 1647, 60: "[p]riapismus est diutina colis sine libidine arrectio. Haec oritur ex eo, quod spiritus animales aquosi et crassi, fungosum penis nervum ingressi, tum propter crassitiam suam per insensibilem transpirationem ex eo non satis dissipentur, tum propter materiam aquosam, citra libidinem, prostatarum poros replentem, in partes corporis, unde venerunt, redire nequeant; atque ideo penem vel perpetuo, vel nimis diu extendant."

7), even if collaboration between them cannot be proven – the spirits coming into the inflating muscle D from the brain cannot move into the other muscle E via the passage ef, for the reason that, given the conformation of the valve Hfi, they would need to reverse their direction of movement. Accordingly, they both tried to figure out how to render such valves and to make sense – visually – of Descartes’s account, in which the functioning of the valves is essential, but which cannot be grasped by the text only. A text (in both the editions) which nonetheless does not contradict a visual representation of the valves – such as that of Van Gutschoven and La Forge – immune to Descartes’s criticism to Regius.

As to this, it is worth noting that Schmaltz has acknowledged in the lack of a X-shaped or diagonal disposition of the channels of the nerves, in Regius’s figure, the cause of his error:

The difficulty for Regius seems to be [...] that he does not have a way of accounting for reciprocal antagonistic action. For his diagram [i.e. Figure 3] suggests that the stronger flow into B leaves G open, and so allows for a flow of spirits into muscle C, thus preventing the disparity that causes the eye to turn toward B. It is the lack of Descartes’s connecting diagonal tubes with different directional flows that seems to be the real source of the problem for Regius’s account. (Schmaltz 2016a, 77)

Nonetheless, such a link made between the diagonal channels and the failure of the spirits to inflate just one muscle seems not to be enough clear, because such a disposition, per se, does not allow for the alternating inflation of antagonist muscles. Rather, the valves seem to play an essential role in this process – and indeed Regius was to correct his point without postulating a different disposition of the channels, but only admitting a different shape of them. Moreover, also La Forge (who, contrary to Van Gutschoven, probably did not see Descartes’s figure as given in Schuyt’s 1662

edition before finalizing his own)⁵⁸ did not represent the diagonal disposition of channels in his figure (Figure 7), which can be barely inferred from the text,⁵⁹ and which can be found in Van Gutschoven's version (Figure 4), which nonetheless might have been influenced by the figure provided by Schuyl (Figure 2), as Clerselier claims that it was exactly because of Van Gutschoven's delays that he postponed the publication of his edition for two years, up to 1664: at which point he had access to the edition of Schuyl.⁶⁰ In fact, La Forge's figure was not deemed as inconsistent with

58 See *infra*, n. 60.

59 Indeed, Descartes specifies that the animal spirits coming from one muscle to the other move upwards: so that we should suppose that the connecting tubes cross each other: see *supra*, n. 47.

60 The chronology of the preparation of the figures of Clerselier's edition can be reconstructed as follows. Just after the publication of the first volume of Descartes's correspondence (finished to be printed on 30 January 1657: Descartes 1657–1667, vol. 1, *Table des lettres*, iv, unnumbered) Louis (1604–1670) and Daniel Elzevier (1626–1680) contacted Clerselier as they heard he was in possession of an autograph, in order to check if the work of Huyberts (mentioned *supra*, n. 22) on the figures of *L'homme* was good. Certainly, because they were willing to publish it: Descartes 1656, *Typographus ad lectorem*. Clerselier sent a copy of the autograph to Huyberts, with the promise of receiving in turn his figures: after the delivery of the copy, however, he lost any contact with him: Descartes 1664b, *Preface*, vi. Afterwards (25 April 1659, as discussed in Section 4) Clerselier asked Regius to contribute to his edition by preparing the figures: Regius rejected such an invitation on 9/19 October 1659, in the meantime, Clerselier had published the second volume of Descartes's correspondence (finished to be printed on 28 May), with a call for illustrators for his planned edition of *L'homme*: Descartes 1657–1667, vol. 2, *Preface*, xiv, and 565 (unnumbered). Moreover, on 4 October, René François de Sluse (1622–1685), having seen Clerselier's call, wrote to Blaise Pascal (1623–1662) asking information about how to reach Clerselier, as he had in mind Van Gutschoven as someone who could fulfil and who could be willing for this task. In turn, around October–November 1659 Clerselier, having acknowledged Regius's refusal, asked Pierre Guisony (a French physician), to look, in the Netherlands, for anybody having the original figures of Descartes, or for anybody willing to prepare them for an edition. Guisony met Van Gutschoven at Leuven, and heard that Sluse wanted to involve him in the project. Clerselier reached in a short time (probably around 29 November) an agreement with Van Gutschoven for the sending to him of a copy of the treatise and for receiving the figures as they were gradually completed. However, as late as on 24 April 1660 (as reported by Sluse) Clerselier had not received yet the letter(s) of Van Gutschoven – be

Descartes's account by Clerselier in its commentary (Descartes 1664b, *Preface*, xix–xx).

4. Conclusion

To sum up, in his 1646 *Errata* Regius attempted to correct the error (likely) noticed by Descartes, who did not pay attention to the *Errata* themselves, while in the 1654 and 1661 editions of his

delivered him by a French physician who visited him at Louvain, certainly Guisony –, by which the delivery of a copy for him had to be finalized. Eventually, on 8 May Sluse wrote Pascal sending him (for Clerselier) a copy of the undelivered letter(s) of Van Gutschoven, and asking for a copy of the treatise: Descartes 1664b, *Preface*, ix–x; Sluse to Pascal, 4 October 1659: Pascal 1897–1914, vol. 9, 355–356; Sluse to Pascal, 29 November 1659: Pascal 1897–1914, vol. 9, 357; Sluse to Pascal, 24 April 1660: Pascal 1897–1914, vol. 9, 393–394; Sluse to Pascal, 8 May 1660: Pascal 1897–1914, vol. 9, 395. In fact, as revealed by Clerselier himself, almost one year after their agreement (i.e. around summer 1660), he had not received any news from Van Gutschoven, and therefore had not sent him the copy. At that point, Clerselier finally received Van Gutschoven's letter(s) through the mathematician François de Nonancourt (1624–1686), friend of Van Gutschoven, who was at Paris after the Treaty of the Pyrenees (7 November 1659) and for the Joyous Entry of Maria Theresa of Spain (1638–1683) at Paris (26 August 1660). So that we can suppose that Van Gutschoven contacted Clerselier both via Sluse-Pascal, and, more directly, via Nonancourt. Around the same time, Clerselier received a letter of La Forge (with whom he was coming in contact for the first time) positively answering to the call of illustrators, on the condition to be the only one working on them. In order to secure the figures, Clerselier, in agreement with Nonancourt, chose to charge both Van Gutschoven and La Forge of their preparation, without informing one about the other, and gave the already prepared copy for Van Gutschoven to Nonancourt in order for it to be delivered, and had a copy for La Forge made and shipped: Descartes 1664b, *Preface*, x–xii. Less than one year afterwards (in fact, no later than February 1661), La Forge sent Clerselier all his figures as well as his *Remarques* on *L'homme* and *Traité de l'esprit de l'homme* (Descartes 1664b, *Preface*, xii) while Van Gutschoven sent at least some of his figures. Indeed, on 17 February 1661 Christiaan Huygens (1629–1695) noticed, in his *Journal*, to have seen some of the figures of the treatise at Clerselier's place, both of La Forge and Van Gutschoven: Huygens 1888–1950, vol. 22, 555. The figures, in fact, were completed at different stages: indeed, Clerselier reports that La Forge and Van Gutschoven accepted some of his suggestions on them, after having delivered them to him on a first time. And even if according to Clerselier both Van Gutschoven's and La Forge's figures were prepared before they could see Schuyt's 1662 edition (in fact, even before Schuyt sent Clerselier a copy

Fundamenta physices Regius was to note that according to his model, the spirits flow back to the brain via the funnel-shaped tubes and the opposed muscle and nerve, whereas in the 1646 edition of the book he relied on the idea of circulation of spirits only (Regius 1654, 324; cf. Regius 1661a, 380–381).⁶¹ All these explanations, however, appear as *a posteriori* corrections of a model based on an incomplete understanding of Descartes’s *L’homme*, determined by the lack of an appropriate figure, and by a text not clearly conveying an explanation of the movement of muscles, especially in Schuyl’s version. To Descartes’s treatise, moreover, Regius appears to revert also in those place already influenced by such a text in his *Physiologia* (whether or not Model Two had already been suggested Regius by Descartes): namely in his accounts of passions and hunger. As to passions, as presented in Table 1, the account given in Regius’s *Physiologia* is expanded, in Regius’s *Fundamenta physices*, in a way clearly matching that given in Descartes’s *L’homme* (from which he borrows more in detail also the metaphor of the sails), as noticeable in the textual similarities between *L’homme* and *Fundamenta physices* signalled in bold (while the underlined text indicates similarities common to these texts and Regius’s *Physiologia*).⁶² As to hunger, as shown in Table 2, one can note textual similarities between Descartes’s *L’homme* and Regius’s *Fundamenta physices* (signalled in bold), other than those already present in Regius’s *Physiologia* (underlined). Moreover, a more dubious appropriation (as it could have been drawn from Descartes’s *Principia*), concerning the related theme of digestion, can be found on Table 4, where the textual similarities

of the figures and of the text in his possession), most probably Van Gutschoven completed them after having seen Schuyl’s 1662 edition (published in summer 1662: Niels Steensen to Thomas Bartholin, 26 August 1662: Bartholin 1663–1667, vol. 3, 103–113), given his two-years delay: Descartes 1664b, *Preface*, v and xii–xiii Last but not least, Schuyl and Van Gutschoven came in contact before the publication of Clerselier’s edition: see *supra*, nn. 13 and 37.

61 It might be that Regius had known such criticism – before its publication in Clerselier’s edition of Descartes’s correspondence in 1657 – from Elisabeth herself, with whom he was in contact: see Antoine-Mahut 2016. In any case, a more overt reaction to such a criticism came only with the publication of Descartes’s correspondence: see *supra*, n. 55.

62 See also *supra*, n. 16.

between the texts are signalled in bold.

All such appropriations – present in chapters ten and twelve of Regius’s *Fundamenta physices* – shed some light on Descartes’s claim that Regius read his text at an advanced stage during the printing of his *Fundamenta physices*, namely, when the printing of his work “had almost been complete,” which can be enlightened also by some additional sources. The appropriations start at pages 167–169 (with chapter ten starting at page 153), and we know that 256 pages out of 306 were already printed on 21 August 1646, when Constantijn Huygens wrote to Mersenne to have already seen such printed pages, and that “the printing comes towards the end.”⁶³ Actually, the book was finished to be printed at the end of the same month, as on 1 September Regius sent Huygens three complimentary copies of it (one of which for the Stadtholder, upon suggestion of Jonsson).⁶⁴ Given the extent of the appropriations, Regius had access to a copy (probably with the help of Jonsson, as discussed above) certainly before late August 1646. We can suppose that he had access to it in late spring or early summer 1646, as suggested by the correspondence of some members of the Dutch circle of Sorbière, to which Regius, Jonsson, Elisabeth, Heereboord, and others belonged.

In fact, Sorbière was well informed about the publication of Regius’s *Fundamenta physices*, as he himself wrote about it to Thomas Hobbes (1588–1679) on 21 May 1646, announcing that it was in course of printing by Louis Elzevier, who was to print also Hobbes’s *De cive* (first edition 1642), apparently after Jonsson had already promised Hobbes a copy.⁶⁵ Another member of the

63 Huygens to Mersenne, 21 August 1646: Mersenne 1933–1988, vol. 14, 413.

64 Regius to Huygens, 1 September 1646: Amsterdam, Universiteitsbibliotheek, ms. K 137, partially transcribed in Huygens 1911–1917, vol. 4, 346–347. The book was received in its final form by Huygens between 12 and 27 September 1646. Indeed, on 12 September he wrote to Mersenne that the book had not yet been published – asking him to be patient for a while –, whereas on 27 September he commented, in his letter to Jonsson mentioned *supra*, n. 36, upon what was certainly a complete printed version. See Huygens to Mersenne, 12 September 1646: Huygens 1911–1917, vol. 4, 547–550.

65 Sorbière to Hobbes, 11/21 May 1646: Hobbes 1994, vol. 1, 128–129; Hobbes to Sorbière, 1 June 1646: Hobbes

circle and associate of Regius, namely Henricus Bornius (1617–1675), in turn, promised on 28 May copies to Gassendi,⁶⁶ reiterating his promise on 9 July, when he remarked that its printing was towards the end, and that it could have already been finished if Regius had not delayed it.⁶⁷ So that we can suppose that Regius could get a copy of *L'homme* between 28 May and 9 July 1646, or slightly before, as it was between such dates that the printing of his *Fundamenta physices* had been delayed. In particular, as revealed by a letter of Sorbière to Hobbes of late September 1646, dealing with the printing of Hobbes's *De cive* (eventually published in 1647), the printing of Hobbes's book had been postponed because Regius sent Elzevier some additions when the latter was already at work on the book, and this caused a "tiresome" delay in the printing.⁶⁸ Probably, some already printed parts had to be re-printed – and this of course did not allow Regius any further change viz. correction on his text, but in the *Errata*. In any case, Regius certainly got a copy of *L'homme* after July 1645, when Descartes, after having read a draft of Regius's *Fundamenta physices*, criticized his positions in metaphysics – proposed in chapter twelve, *De homine* – and his order of presentation, but did not comment upon Regius's theory of the movement of muscles, or his other appropriations of the treatise.⁶⁹

Moreover, such appropriations, concerning topics other than that of muscular movement and precisely those already bearing witness of an acquaintance with contents of *L'homme* in 1641, suggest that Regius systematically looked for those Cartesian theories of which he already made use. This indicates that probably also Model Two might have been suggested him by Descartes.

1994, vol. 1, 131–132. Hobbes was eager to get a copy after having read Regius's *Physiologia*.

66 Bornius to Gassendi, 28 May 1646: Gassendi 1658, vol. 6, 498–499.

67 Bornius to Gassendi, 9 July 1646: Gassendi 1658, vol. 6, 499.

68 Sorbière to Hobbes, late September 1646: Hobbes 1994, vol. 1, 136. This letter, dated only 1646 was received by Hobbes around 2 October 1646, namely circa 20 days before his letter to Sorbière of 22 October 1646 (as reported in such letter of 22 October): Hobbes to Sorbière, 12/22 October 1646: Hobbes 1994, vol. 1, 141–142.

69 Descartes to Regius, July 1645: Descartes and Regius 2002, 187–188 (also in AT IV, 248–250).

Eventually, it is worth remarking, first, that Regius never admitted even of having read this treatise. In the version of Regius's dedicatory letter to the Stadtholder appended to the second edition of his *Fundamenta physices*, published as *Philosophia naturalis* in 1654, which was a re-issue of his 1646 letter, Regius eliminated all mention of Descartes (already scarce in the first version). This led Clerselier, in the preface to the first volume (1657) of his edition of Descartes's correspondence, to accuse Regius of having drawn theories from Descartes's works – including his unpublished ones (thereby referring to his *L'homme*) – without giving him the due credit (Descartes 1657–1667, vol. 1, *Preface*, xii). Notwithstanding these polemics, in a letter of 25 April 1659 Clerselier asked Regius, before turning to La Forge and Van Gutschoven, to help him with the figures of Descartes's *L'homme* and *La description du corps humain*. Regius declined Clerselier's request in a letter of 9/19 October 1659 (published as a booklet in 1661). There he declares to have never seen and not to deem such treatises, which Clerselier claimed to own, as actually Cartesian texts, for the reason that Descartes warned (in his *Discours*) not to consider anything not published by him as a text of his (notwithstanding Regius having explicitly referred to Descartes's unpublished *Le monde* as an authoritative source in his 1642 *Responsio sive Notae* against Gisbertus Voetius, 1589–1676). Regius further excused himself from helping Clerselier by citing his on-going work on “the third edition of [his] *Physica*” and mentioned the likely “new calumnies” that would arise if that effort coincided with helping Clerselier.⁷⁰ But, again, the evidence that Regius had access to Descartes's *L'homme* – also before 1646 – is overwhelming.

70 Regius 1661b, 39–40. See Regius 1642, 20; AT VI, 69–70. See also Descartes 1664b, *Preface*, vi–ix. The 1661 edition of Regius's letter was prefaced by Fabricius, and was numbered and bounded together with the copies of the 1657 edition of Regius's *Brevis explicatio*. Clerselier's letter is now lost.

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Table 1

Descartes's <i>L'homme</i>	Regius's <i>Physiologia</i> (1641)	Regius's <i>Fundamenta physices</i> (1646)
<p>[L]a source qui produit ces esprits est ordinairement si abondante, qu'à mesure qu'ils entrent dans ces concavités, ils ont la force de pousser tout autour la matière qui les environne, et de l'enfler, et par ce moyen de faire tendre tous les petits filets des nerfs qui en viennent; ainsi que le vent, étant un peu fort, peut enfler les voiles d'un navire, et faire tendre toutes les cordes auxquelles elles sont attachées; d'où vient que pour lors cette machine étant disposée à obéir à toutes les actions des esprits, représente le corps d'un homme qui veille; ou du moins ils ont la force d'en pousser ainsi et faire tendre quelques parties, pendant que les autres demeurent libres et lâches, ainsi que font celles d'une voile, quand le vent est un peu trop faible pour la remplir; et pour lors cette machine représente le corps d'un homme qui dort [...].</p> <p>[C]es esprits trouvent là deux pores,</p>	<p>Iudicium saepe comitem habet affectum, qui est impetus, quo anima ab opinione obiecti boni vel mali diversimode affecta, spiritus animales ope conaris varie per nervos in <u>cor</u> eiusque vasa propellit; quo illa plus solito vel <u>constringuntur</u>, vel dilatantur, sanguisque vel parcius vel copiosius per corpus distribuitur, unde totum corpus deinde varie perturbatur. [...]. Affectus itaque est tantum duplex: laetitia et tristitia. Laetitia est affectus, quo anima ex iudicio obiecti boni voluptate quadam affecta cor vehementius dilatat, sanguinemque et spiritus copiosius per corpus propellit. Tristitia est affectus, quo anima ex iudicio obiecti mali dolore quodam affecta, cor constringit, sanguinemque et spiritus parcius per corpus distribuit. [...].</p> <p>Appetitus sensitivus simplex est motus quidam spirituum a receptione excitatus, quo meatus quidam nervorum ad apertionem vel</p>	<p>Spiritus hi pro vario suo motu, apti sunt instar variarum clavium, varios aperire cerebri et nervorum poros. Atque ideo alius observatur motus corporis, in laetitia, alius in tristitia, alius in aliis affectibus. Iique aliquando sunt copiosiores, aut vehementius moti, et expandunt cerebrum cum annexis nervis, instar venti vehementioris vel copiosioris velum cum annexis funibus expandentis: aliquando vero sunt pauciores, vel minori vi agitati, tumque patiuntur cerebrum cum suis nervis subsidere et complicari, ut velum ob ventum pauciolem vel leniorem subsidere et complicari solet. [...].</p> <p>Appetitus sensitivus simplex, est motus quidam spirituum, a receptione excitatus, quo meatus quidam nervorum ad apertionem vel clausionem vellicantur; unde, ad certam quandam <u>rem vel</u></p>

<p>ou passages principaux oR, os; l'un desquels, à savoir oR, les conduit en tous les nerfs qui servent à mouvoir les membres extérieurs, en la façon qui est requise pour éviter la force de cette action, comme en ceux qui retirent la main, ou le bras, ou tout le corps; et en ceux qui tourment la tête et les yeux vers ce feu, afin de voir plus particulièrement ce qu'il faut faire pour s'en garder. Et par l'autre os, ils vont en tous ceux qui servent à causer des émotions intérieures, semblables à celles qui suivent en nous de la douleur; comme en ceux qui resserrent le cœur, qui agitent le foie, et tels autres; et même aussi en ceux qui peuvent causer les mouvements extérieurs qui la témoignent; comme en ceux qui excitent les larmes, qui rient le front et les joues, et qui disposent la voix à crier. [...]</p> <p>Et remarquez que j'ai particulièrement distingué les deux pores oR et os, pour vous avertir qu'il y presque toujours deux sortes de mouvements qui procèdent de chaque action; savoir les</p>	<p>clausionem vellicantur, unde ad certam <u>aliquam rem vel assequendam vel fugiendam sumus proclives</u>, saepe etiam inscii et inviti. Hunc saepe comitatur affectus sensitivus, qui est perturbatio corporis a motu spirituum a receptione orto originem ducens, <u>qua cor plus solito vel contrahitur</u> reliquumque corpus varie afficitur. Motus spontaneus est motus a receptione excitatus, quo spiritus ita moventur, ut certos quosdam meatus nervorum aperiant, quo fit, ut spiritus influentes, has vel illas partes moveant, saepe etiam nobis insciis, imo etiam invitis, eo fere modo ut in automatis pneumaticis et hydraulicis contingit.</p> <p>(Regius 1641–1643, 43–44 and 47).⁷¹</p>	<p><u>assequendum, vel fugiendum, animal est proclive</u>. [...] Hunc saepe comitatur affectus sensitivus, qui est perturbatio corporis, a sanguine et spiritibus, ex receptione vel alia causa varie motis, et cordis vasa et ventriculos diversimode, pro motus sui ratione, dilatantibus vel arctantibus, aliasque corporis partes varie agitantibus, originem ducens.</p> <p>Prout enim spiritus sunt copiosiores vel pauciores, tenuiores vel crassiores, vehementiores vel imbecilliores, aequaliores vel inaequaliores, item hoc vel illo modo agitati, ita varium habent motum, iique, pro motus sui varietate, apti sunt hos vel istos cerebri et nervorum poros, instar variarum clavium, aperire, in diversas cordis et reliqui corporis partes fluere, eoque, illas varie movendo, aperire vel claudere vel aliter agitare; et ita corpus varie afficere. Sic ex. gr. ubi spiritus sunt solito copiosiores, puriores, et agiliores, tales motus in corde et reliquo corpore excitant, qui signa amoris, laetitia, spei, constantiae, benignitatis, et bonae corporis</p>
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71 Cf. Descartes's letter to Regius of July 1641, criticizing Regius's reduction of all passions, presented in this text, to joy and sadness: Descartes and Regius 2002, 76 (also in AT III, 66).

<p>extérieurs, qui <u>servent à poursuivre les choses désirables</u>, ou à éviter les <u>nuisibles</u>, et les intérieurs, qu'on nomme communément les passions, qui servent à disposer le cœur et le foie, et tous les autres organes desquels le tempérament du sang, et ensuite celui des esprits, peut dépendre; en telle sorte que les esprit qui naissent pour lors, se trouvent propres à causer le mouvements extérieurs qui doivent suivre. Car supposant que les diverses qualités de ces esprits sont l'une des circonstances qui servent à changer leur cours, ainsi que j'expliquerai tout maintenant, on peut bien penser, que si par exemple, il est question d'éviter quelque mal par la force, et en le surmontant, ou le chassant, à quoi incline la passion de la colère, les esprits doivent être plus inégalement agités, et plus forts que de coutume; et au contraire, que s'il faut l'éviter, en se cachant, ou le supporter avec patience, à quoi incline la passion de la peur, ils doivent être moins abondants, et moins forts; <u>et pour cet effet le cœur se doit resserrer</u> pour lors, comme pour les épargner et</p>		<p>constitutionis, solent exhibere [...]. Ubi leniter et aequaliter moventur, modestiae, lenitatis, mansuetudinis; ubi vehementius et inaequalius, ferociae, superbiae, irae, notas praebent. Tum autem ira potissimum oriri solet, ubi ex motu spirituum, a receptione orto, fibrillae ductuum biliariorum ita moventur, ut quaedam tenuiores et calidiores bilis partes, cum sanguine mixtae, et ad cor cum eo delatae, sanguinem in corde vehementius incendunt, spiritusque in cerebro fortius agitent. Quemadmodum tristitia tum praecipue oritur, ubi ex motu spirituum meatus quidam in liene aperiuntur, qui sanguinem ad dilatandum ineptiorem ex certis poris expellit, eumque cum reliquo sanguine, in liene existente, et inde ad hepar et cor abeunte, miscet, sanguinisque iustum in corde fervorem spirituumque agilitatem tollit. [...] Et quoniam pori cerebri, a recepto obiectorum motu aperti, non tantum in hos vel illos nervos et musculos, membris movendis aptos; sed etiam in diversas cordis aliarumque partium fibras, laetitiae, tristitiae, timoris vel</p>
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<p>réserver pour le besoin: et vous pouvez juger des autres passions à proportion. (Descartes 1664b, 68–69, 96, and 97–98; cf. Descartes 1662, 76 and 109–111)</p>		<p>irae affectibus excitandis, et per gannitus, eiulatus, risum, rictum, vel lacrymas significandis idoneas desinunt: ideoque solet fere semper a vehementiore obiectorum motu, non tantum varius, pro recepti motus varietate, corporis motus, <u>ad rem obiectam prosequendam vel fugiendam idoneus</u>; sed etiam varius laetitiae, tristitiae, irae, timoris, vel pudoris affectus, saepissime risu, lacrymis, clamoribus, erubescencia , ex pallescentia, minaci oris rictu, rugosa fronte, vel aliis signis indicatus, oriri. [...]</p> <p>Iudicium saepe comitem habet affectum; qui est impetus, quo mens, ab opinione obiecti boni vel mali diversimode affecta, illudque ope corporis vel fugere, vel prosequi, vel aliter dirigere cupiens, spiritus animales ope conarii, quod perpetuo a spiritibus animalibus et subtili materia agitatur, varie per nervos in <u>cor</u> eiusque vasa et fibras, aliasque corporis partes determinat; quo illa plus solito vel <u>constringuntur</u> vel dilatantur, sanguisque vel parcius vel copiosius per corpus distribuitur, unde totum corpus deinde varie perturbatur.</p>
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		<p>[...] Affectus praecipui hi numerantur: amor, odium, laetitia, tristitia, spes, desperatio, audacia, timor, ira, pudor.</p> <p>In laetitia, amore, spe, ira, audacia, pudore, aliisque similibus affectibus, ita determinantur spiritus in cerebro, ut isti in illas cordis et hepatis fibras fluant, quae orificia et vasa cordis latius aperiunt, et hepatis poros ita disponunt, ut calidior sanguinis pars a reliquo ibi separetur, et ad cor copiosius feratur, atque ita maius in corde incendium excitetur, et sanguis, propterea largius per totum corpus vel certas partes distributus, ruborem in illis plerumque excitet. (Regius 1646, 224–225, 240–241, and 288–290)</p>
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Table 2

Descartes's <i>L'homme</i>	Regius's <i>Physiologia</i> (1641)	Regius's <i>Fundamenta physices</i> (1646)
<p>Lors que les <u>liqueurs</u>, que j'ai dit ci-dessus servir comme d'eau-forte <u>dans</u> son <u>estomac</u>, et y <u>entrer sans cesse</u> de toute la masse du sang <u>par les</u> extrémités des <u>artères</u>, <u>n'y trouvent pas assez</u> de viandes à <u>dissoudre</u> pour occuper toute leur force, elles la <u>tournent contre l'estomac</u> même, et agitant les petits filets de ses nerfs plus fort que de coutume, font mouvoir les parties du cerveau d'où ils viennent: ce qui sera cause que l'ame étant unie à cette machine concevra l'idée générale de la faim.</p> <p>Et si ces liqueurs sont disposées à [in Schuyf's version: <i>liquor ille eius sit temperamenti, ut</i>] employer plutôt leur action contre certaines viandes particulières que contre d'autres, ainsi que l'eau-forte commune dissout plus aisément les métaux que la cire, elles <u>agiront aussi d'une façon particulière contre les nerfs</u> de l'estomac, laquelle sera cause que l'ame <u>concevra</u> pour lors l'appétit de</p>	<p>Fames est appetitus cibi, ortus est ex morsu inaniti ventriculi ab acribus quibusdam <u>succis, ex arteriis in ventriculum continuo illabentibus</u>, qui post expulsionem chyli, <u>non inuenientes quod corrodant, ventriculum pungunt</u>, quo <u>nerui sextae coniugationis certo modo moti, imaginationem excitant cibi sumendi</u>, in morsus illius remedium. (Regius 1641–1643, 18)</p>	<p>Fames est appetitus cibi, ortus est ex morsu inaniti ventriculi, ab acribus quibusdam <u>succis, ex arteriis in ventriculum continuo impulsis</u>, qui post expulsionem chyli, <u>non inuenientes quod corrodant, ventriculum pungunt</u>, quo <u>neruus sextae coniugationis certo modo in eo motus, imaginationem cibi sumendi excitat</u>, in morsus illius remedium.</p> <p>Prout autem isti succi peculiarem rationem ad hunc vel illum cibum dissolvendum habent, ita huius vel istius cibi sumendi appetitum movent.</p> <p>Quod in multis virginibus et mulieribus, pica laborantibus, passim animadvertitur. (Regius 1646, 167)</p>

<p><u>manger de certaines viandes, plutôt que d'autres.</u> (<i>Hic notari potest mira huius machinae conformatio, quod fames oriatur ex ieiunio; sanguis enim circulatione acrior fit; et ita liquor ex eo in stomachum veniens nervos magis vellicat; idque modo peculiari, si peculiaris sit constitutio sanguinis; unde pica mulierum</i>). (Descartes 1664b, 55–56; cf. Descartes 1662, 65–66).⁷²</p>		
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Italics by Clerselier (marking a Latin paragraph in the manuscript used for his edition) – present also in Schuyf's edition.

Table 3

Schuyt's 1662 edition	Schuyt's 1664 edition	Clerselier's 1664 edition
<p>[...] ut formare possint ideam obiecti D. Unde concludo actionem non esse adeo vivam, nec adeo efficacem, quam a, b, c. Ex quibus manifestum est, ideas sibi mutuo obesse: adeoque pluribus intentis, minor est ad singula sensus. Notandum itidem, quotiescunque sensuum organa fortius ab hoc, quam ab illo affici incipiunt, nondum prorsus accurate ad actionem [...].</p> <p>[...] largior copia Bacchi, similesque alii excessus: et eiusmodi, quaecunque natura secundum temperamentorum diversitatem spirituum vim augentia, vel diminuentia, nimias vigilias, vel etiam nimium somnum inducere possint [...]. (Descartes 1662, 97–98 and 117)</p>	<p>[...] ut formare possint ideam obiecti D. Cuius actionem suppono non esse adeo vividam, nec adeo efficacem, quam a, b, c. Ex quibus manifestum est, quomodo ideae sibi mutuo obsint: adeoque pluribus intentis, minor est ad singula sensus. Notandum itidem, quotiescunque sensuum organa fortius ab hoc, quam ab illo obiecto affici incipiunt, nondum prorsus accurate ad actionem [...].</p> <p>[...] largior copia Bacchi, similesque alii excessus: qui quandoquidem quippiam continent, quo excitetur et augeatur spirituum vigor et quispiam quo idem retundatur et diminuatur, pro diversitate temperamentorum, vel nimias vigilias, vel etiam nimium somnum inducere possint [...]. (Descartes 1664a, 97–98 and 117)</p>	<p>[...] pour y former l'idée de l'objet D, dont je suppose que l'action n'est ni si vive, ni si forte, que celle d'A, B, C; d'où vous voyez comment les idées s'empêchent l'une l'autre, et d'où vient qu'on ne peut être fort attentif à plusieurs choses en même temps. Il faut aussi remarquer, que les organes des sens, lorsqu'ils commencent à être touchés par quelque objet plus fort que par les autres, n'étant pas encore autant disposés à en recevoir l'action [...].</p> <p>[...] le trop boire, et autres tels excès, qui ont en soi quelque chose qui augmente, et quelque chose qui diminue la force de ses esprits, peuvent selon ses divers tempéraments, la faire ou trop veiller, ou trop dormir [...]. (Descartes 1664b, 86 and 104)</p>

Table 4

<p>Descartes's <i>L'homme</i></p>	<p>Descartes's <i>Principia philosophiae</i> (1644)</p>	<p>Regius's <i>Fundamenta physices</i> (1646)</p>
<p>[...] et même les viandes sont telles, pour l'ordinaire, qu'elles se pourraient corrompre et échauffer toutes seules: ainsi que fait le foin nouveau dans la grange, quand on l'y serre avant qu'il soit sec. Et sachez que l'agitation [...]. Ces plus subtiles parties des viandes étant inégales, & encore imparfaitement mêlées ensemble, composent une liqueur qui demeurerait toute trouble & toute blanchâtre, n'était qu'une partie se mêle incontinent avec la masse du sang [...]. (Descartes 1664b, 3–4; cf. Descartes 1662, 3–4)</p>	<p>Quod vero alicuius spiritus aut liquoris particulae, meatus corporis duri, vel etiam liquidi, subeundo, ignem aliquando possint excitare, ostendunt foenum madidum alicubi conclusum, calx aqua aspersa, fermentationes omnes, liquoresque non pauci Chymicis noti, qui dum inter se permiscuntur, incalescunt, ac etiam aliquando inflammantur. (AT VIII/1, 256)</p>	<p>In ventriculo A et intestinis B fit coctio, cum alimenta ore masticata, et per membranaceum oesophagi H, a faucibus per medium thoracem et diaphragma H ad ventriculum usque pertingentis, tubum, eo deglutita ibique sponte, instar foeni humidi in horreo reclusi, incalescentia, vi caloris praecipue a corde E iis communicati, et humoris calidi et acris, ab arteriis gastricis et mesaraicis per ventriculi et intestinorum tunicas sparsis, eo impulsivi et cum alimentis mixti dissolvuntur, et in chylum, seu pultaceam albicantemque quandam materiam, ibi paulatim convertuntur [...]. (Regius 1646, 169)</p>

Figure captions

Figure 1. Representation of a verge escapement clock. Source: Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Horloge_foliot_XIVe_Mécanisme.jpg. The figure has been rendered in black and white. Image licensed under the Creative Commons Attribution-Share Alike 4.0 International license.

Figure 2. Schuyl's representation of antagonist muscles according to an autograph by Descartes. Source: Descartes 1662, 25. Image not covered by copyright (work published before 1900).

Figure 3. Clerselier's representation of antagonist muscles according to a supposed autograph by Descartes. Source: Descartes 1664b, 17. Image not covered by copyright (work published before 1900).

Figure 4. Van Gutschoven's representation of antagonist muscles. Source: Descartes 1664b, 16. Image not covered by copyright (work published before 1900).

Figure 5. Regius's representation of antagonist muscles. Source: Regius 1646, 234. Image not covered by copyright (work published before 1900).

Figure 6. Regius's representation of antagonist muscles. Source: Regius 1661a, 380. Image not covered by copyright (work published before 1900).

Figure 7. La Forge's representation of antagonist muscles. Source: Descartes 1664b, 18. Image not covered by copyright (work published before 1900).

Figure 1

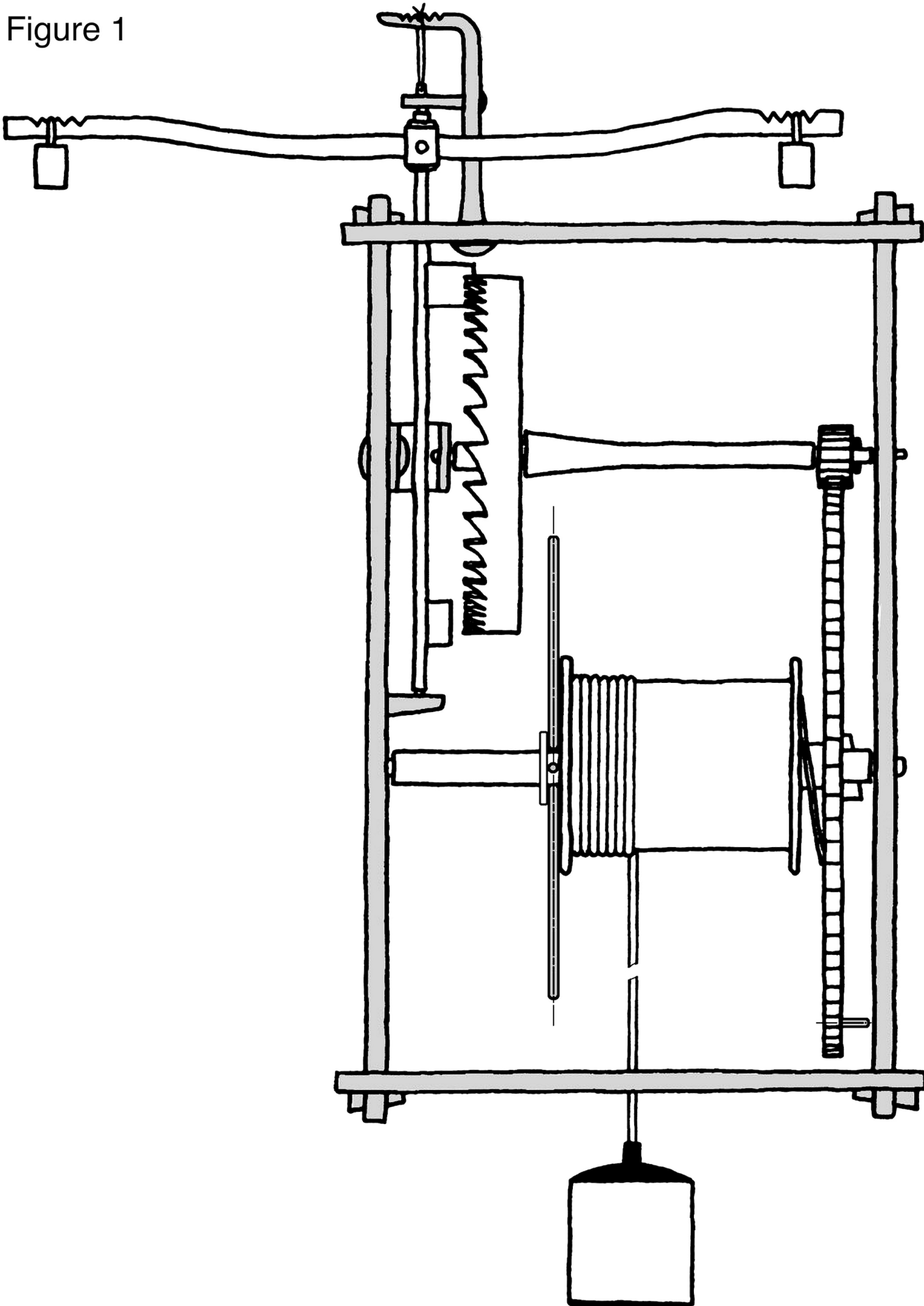
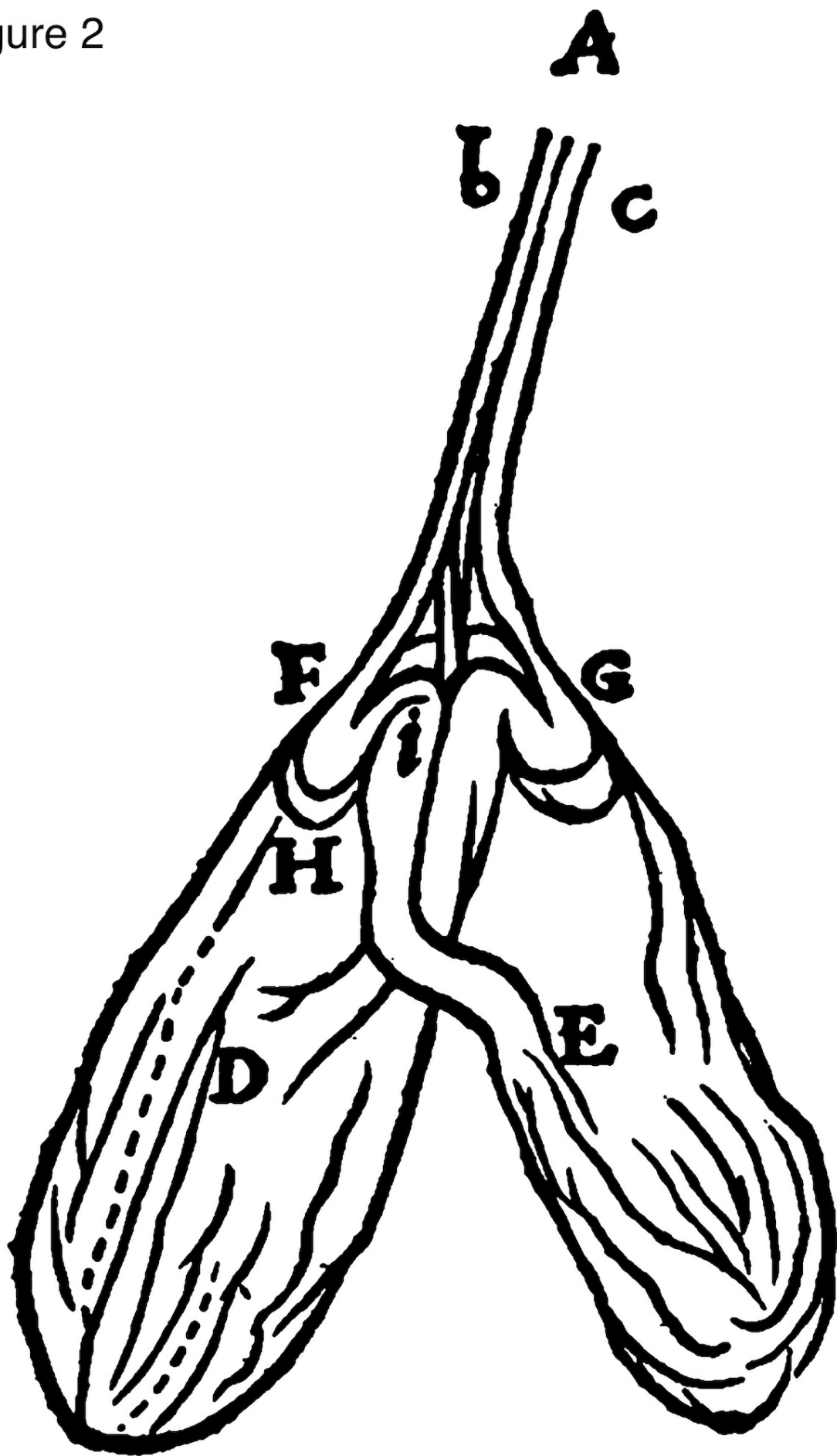


Figure 2



*Figura Musculi secundum an-
tographum Des Cartes delineata.*

Figure 3

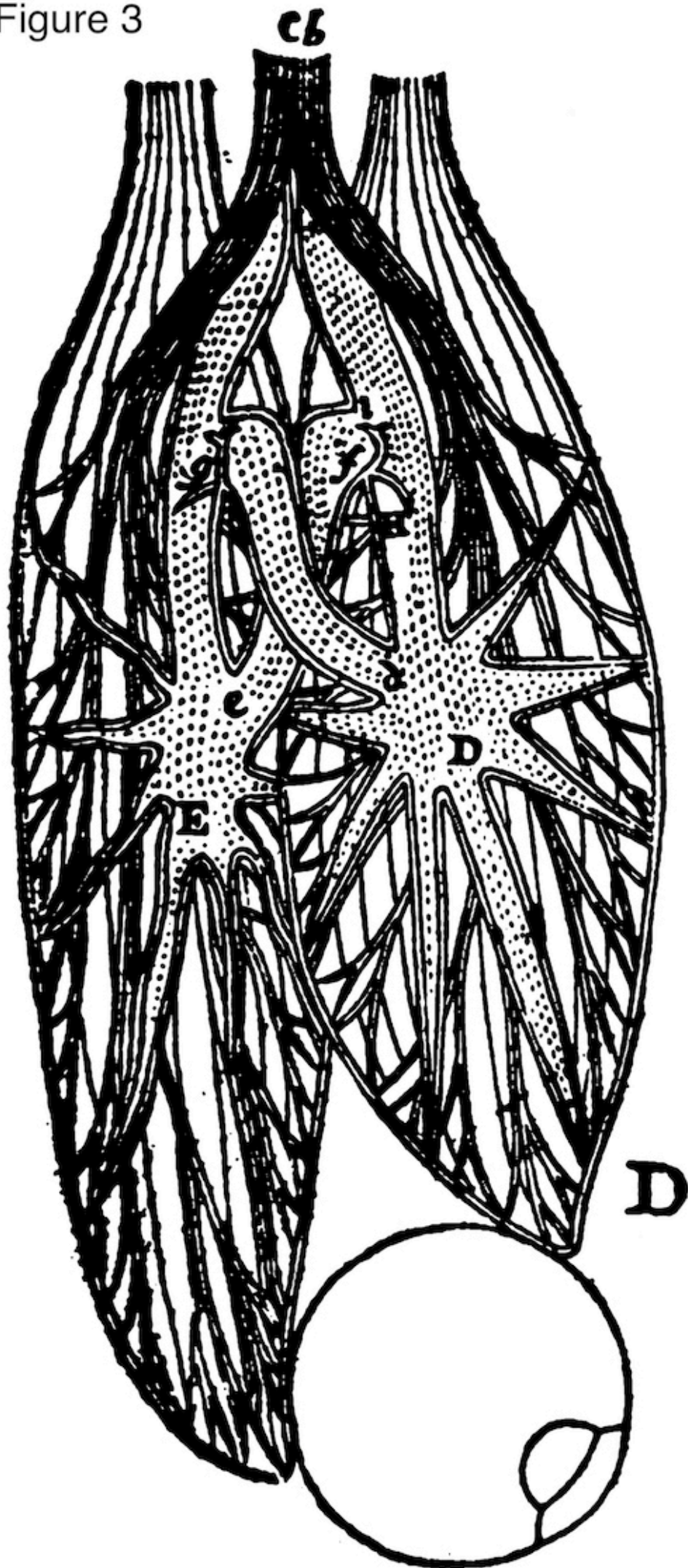


Figure 4

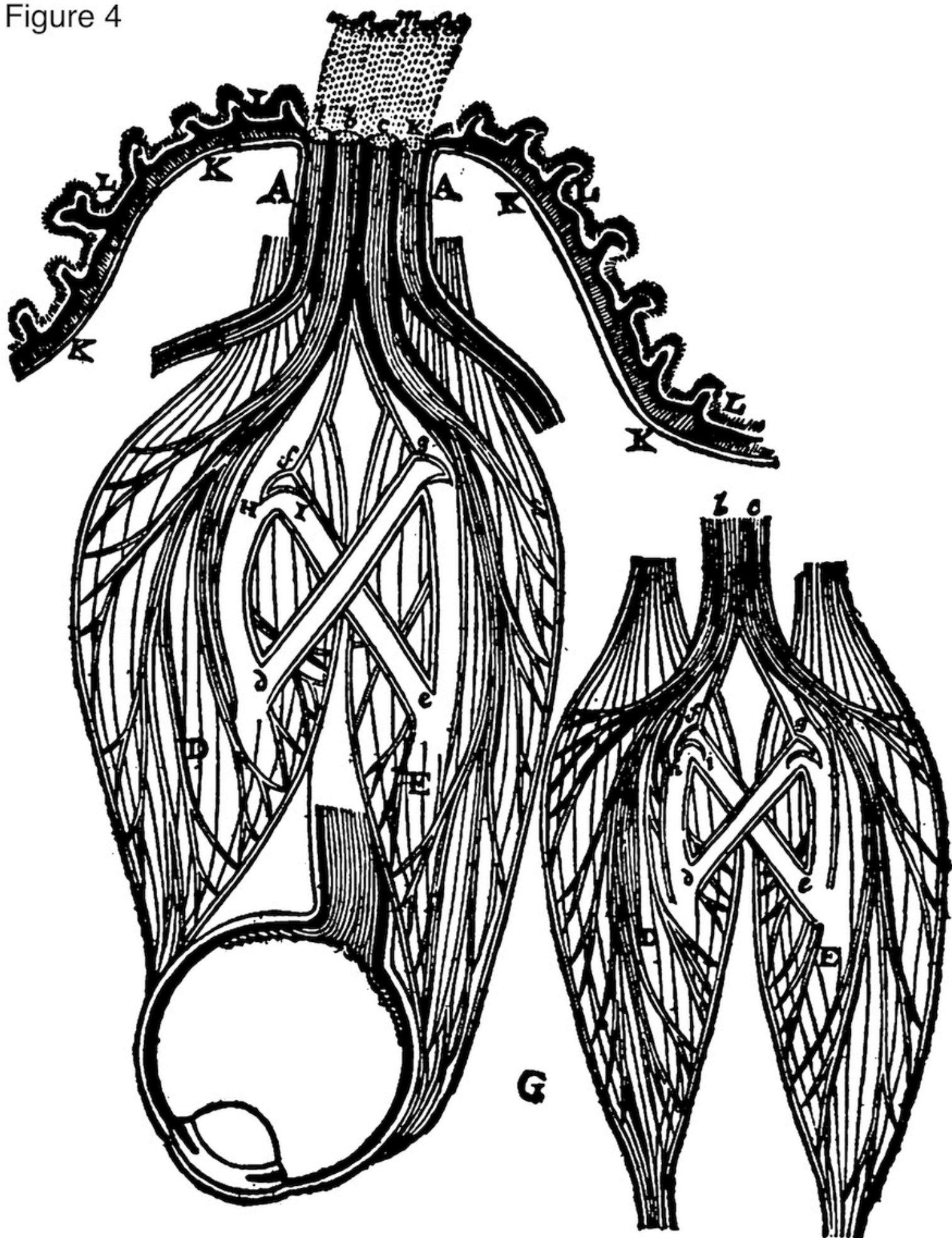


Figure 5

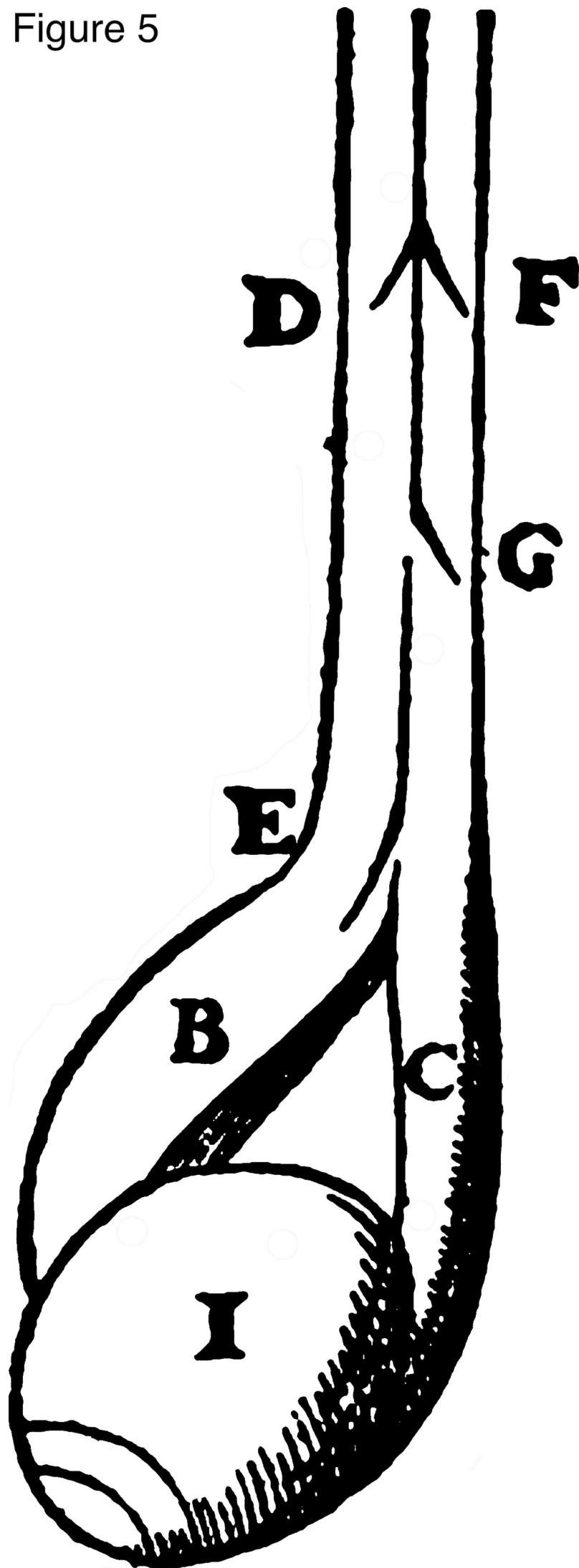


Figure 6

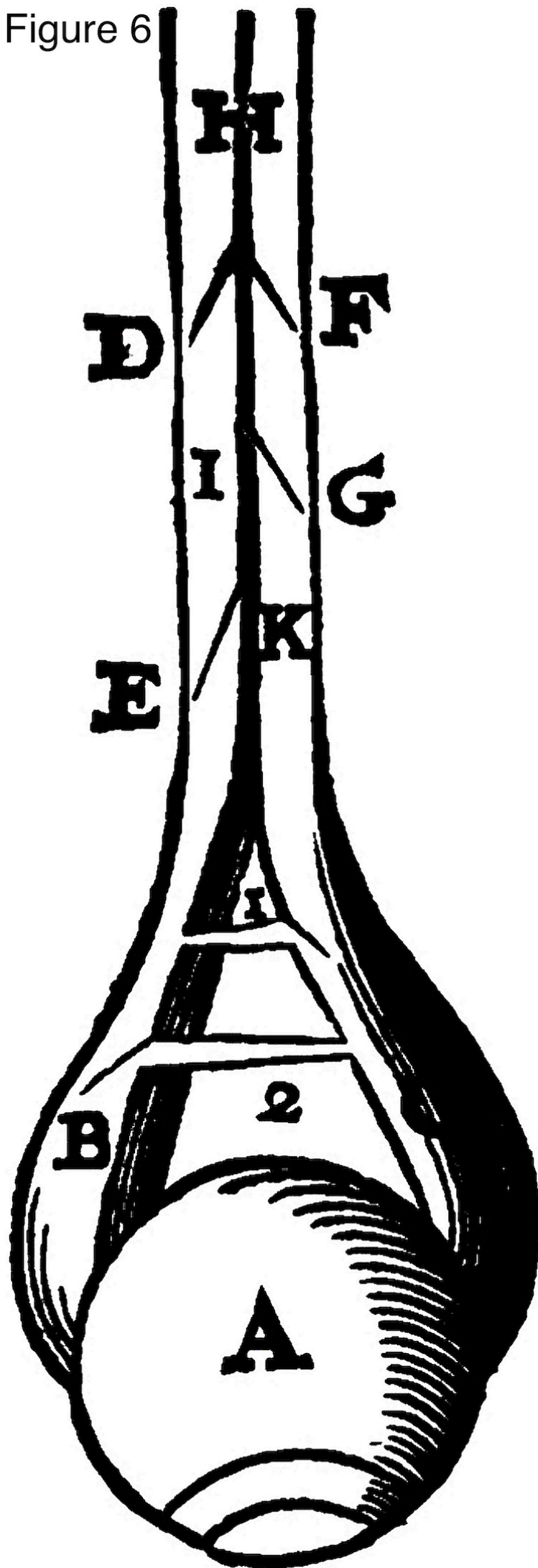


Figure 7

