THE CARTESIAN PHYSIOLOGY OF JOHANN JAKOB WALDSCHMIDT*

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Abstract

This essay examines Descartes's impact on medical faculties in the German Reformed context, focusing on the case of the Marburg physician Johann Jakob Waldschmidt (1644–89). It first surveys the wider backdrop of Descartes-reception in German universities, and highlights its generally conciliatory character. Waldschmidt appears as a counterpoint to this tendency. The essay then situates Waldschmidt's work in the context of confessional politics at the University of Marburg, and specifically of the heightened controversy in Hesse around the teaching of Descartes in the last years of Waldschmidt's life. The second half of the essay details Waldschmidt's ambitious program for reforming medicine along Cartesian lines, in physiology, pathology, and therapy, and evaluates its merits and limits.

Keywords: German Cartesianism; medical Cartesianism; iatromechanism; Radical Pietism

1. *Descartes among the German physicians*

The medical faculties of Central Europe were among the more fertile grounds for the reception of Descartes's natural philosophy. The corpuscular theory of matter and its attendant theory of motion offered physicians a promising new framework for the study of physiology and anatomy. By the end of the seventeenth century, Cartesian ideas had been absorbed in medical teaching and research at Duisburg, Louvain, Leiden, Bern, Marburg, Frankfurt (Oder), and Halle. This

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circumstance would have pleased Descartes, whose lifelong ambition to contribute to the advancement of medicine is well attested.[1]

The German medical reception of Descartes, however, was not so much a revolution as an assimilation to a burgeoning spirit of reform. Sixteenth-century developments in medicine and allied disciplines, from Vesalius's anatomy to Paracelsian chemistry, had made steady inroads in German medical faculties by Descartes's time. Separate chairs in anatomy had become increasingly common. New subfields emerged. In 1609, Marburg appointed Johannes Hartmann (1568–1631) to a new chair of *chymiatrie* within its medical faculty. In Wittenberg, Daniel Sennert (1572–1637) attempted to reconcile explanations of manifest qualities in terms of the chemical *tria prima* (mercury, sulphur, and salt) with the Aristotelian doctrine of elements in his *De chymicorum cum Aristotelicis et Galenicis consensu ac dissensu* (1619). Sennert's student, Werner Rolfinck (1599–1673), professor at Jena from 1629, embraced William Harvey's new theory of the circulation of blood while also retaining his teacher's chemical ontology. In brief, by the mid-seventeenth century the synthesis of Aristotelian natural philosophy and Galenic medicine, as received both in the medical texts of Avicenna and Rhazes and in the humanistic turn toward the ancient sources, had been gradually eroded.

Descartes's mechanical hypothesis concerning the human body thus appeared in an intellectual climate receptive to innovation, in which it had to jostle for influence among rival theories.[2] Unsurprisingly, its impact varied in force and in content from one site to another. It

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[1] *Discourse on Method*, VI, AT VI 62; Descartes to Chanut, 15 June 1646, AT IV 441; Descartes to Cavendish, October 1645, AT IV 329.

[2] The idea for medical purposes of the human body as a machine, or "iatromechanism", is not original with Descartes. Earlier in the seventeenth century, the Padua professor of anatomy Santorio Santori (1561–1636) had developed an account of bodily functions as analogous to the operations of a clockwork, together with a geometrical theory of matter, and a theory of health and disease in quantitative terms. Santorio does not appear to have had much of an impact in

was also invariably colored by theological disputes in the still-tense confessional landscape of German academia in the aftermath of the Thirty Years' War. In this milieu, Reformed institutions in the Rhineland, with their geographical proximity to the Netherlands, played a key role in the transmission of Cartesian ideas.[3] In particular, an incongruous alliance between Cartesianism and a certain strain of Dutch Calvinism, Cocceianism, led the way in habilitating Descartes in Germany.

The preeminent locus of Descartes-reception was the newly-founded university in Duisburg, and its key representative the Dutch-trained philosopher and Cocceian theologian Johann Clauberg (1622–65).[4] Clauberg's commentaries on Descartes played a central role in introducing subsequent generations of German academics to Cartesianism. They also set the tone for the broadly eclectic approach to the new philosophy characteristic of German Cartesianism. Despite his vigorous advocacy of Descartes, Clauberg presented his work not as a replacement for the existing curriculum, as Descartes had hoped the *Principia philosophiae* would be, but as an emendation. In logic and metaphysics, his intent was openly conciliatory. In both areas, Clauberg introduced significant adjustments to later scholastic orthodoxy by means of Cartesian resources which, in the process, led to equally significant divergences from Descartes.[5] It was

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German universities, however, even among Padua-trained physicians such as Rolfinck. See FABRIZIO BIGOTTI, *Physiology of the Soul: Mind, Body and Matter in the Galenic Tradition of the Late Renaissance* (1550–1630), Turnhout, Brepols, 2019, p. 225–68, for Santorio's contributions to anatomy and physiology.

[3] See HEINZ SCHNEPPEN. *Niederländische Universitäten und deutsches Geistesleben*, Münster Aschendorff, 1960, p. 85–92.

[4] See FRANCESCO TREVISANI, *Descartes in Deutschland. Die Rezeption des Cartesianismus in den Hochschulen Nordwestdeutschlands*, trans. by Eckehart Stöve and Klaus Sczibilanski, Vienna, LIT Verlag, 2011, p. 21–38, and NABEEL HAMID, "Domesticating Descartes, Renovating Scholasticism: Johann Clauberg and the German Reception of Cartesianism", in *History of Universities,* 30/2 (2020), p. 57–84, for the context of Descartes's reception in Duisburg.

[5] See TREVISANI, *Descartes in Deutschland,* p. 63–83, for some of Clauberg's departures from Descartes in logic and ontology. See MASSIMILIANO SAVINI, *Methodus cartesiana et ontologie*,

perhaps in his physics that Clauberg came nearest to fulfilling Descartes's ambition of supplanting Aristotelian natural philosophy. Yet, even here, tensions remained, for example between Clauberg's acceptance of genuine secondary efficient causation and the passivity of Cartesian bodies; in his notion of impenetrability; and in his employment of a scholastic distinction between *materia prima* and *materia secunda* to interpret Cartesian *res extensa*, such that the former should be the universal passive principle that God arranges in certain ways to produce secondary matter, or individual corporeal substances.[6]

As rector and doctor of theology, Clauberg's influence in setting the early intellectual spirit of Duisburg extended beyond the arts curriculum. He saw physics as the "root and foundation" of law and medicine and, echoing Descartes, identified the deficient theoretical basis supplied by scholastic physics as a key impediment to the reform of medicine.[7] To remedy the situation, he endorsed Descartes's vision of a practical physics suited to medical physiology. Clauberg sketches the outlines of a new physiology in the third part of his *Physica,* the *Theoria corporum viventium* (1664). He begins with an embrace of Descartes's sharp distinction between mental and corporeal substances, and an account of the latter that explains the operations of bodies in terms of local motions rather than formal powers. The Cartesian theory of matter and

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Paris, Vrin, 2011, for a careful study of Clauberg's debts to and departures from both scholasticism and Cartesianism.

[6] CLAUBERG, Disp. phys. IV. 14–17; XXII. 8–9. References to Johann Clauberg are from *Johannis Claubergii Opera Omnia Philosophica*, edited by Johann Schalbruch, Amsterdam, J. Blaeu, 1691. Cartesian themes certainly predominate in natural philosophy disputations at Duisburg between 1656–61, as TREVISANI, *Descartes in Deutschland,* p. 78, notes. Yet Trevisani agrees with the long-held view, introduced by JOSEF BOHATEC, *Die cartesianische Scholastik in der Philosophie und reformierten Dogmatik des 17. Jahrhunderts*, Leipzig, Deischert, 1912, of treating Clauberg as a 'scholastic Cartesian'. See BUZON FRÉDERIC DE, "La nature des corps chez Descartes et Clauberg. Physique, mathématique et ontologie", in *Chemins du cartésianisme*, edited by Antonella del Prete and Raffaele Carbone, Paris, Classique Garnier, pp. 85–108, for some of the tensions in Clauberg's physics.

[7] CLAUBERG, Disp. phys. I. 11; Th. corp. viv. Praefatio.

its laws supply the basis for a representation of the organic body—plant, animal, and human—as a clockwork, whose parts are disposed to perform their functions strictly by means of corpuscular motions. The suitability of organic parts for particular operations, meanwhile, derives from the divine origins of living machines. In step with Descartes's fable in *Le monde,* Clauberg frames animal bodies as divinely-crafted automata. The difference between healthy and diseased, and ultimately living and dead, bodies is simply that in the latter but not the former the parts of the clockwork have broken down or stopped functioning altogether.[8] The whole human being, meanwhile, is defined as "a thing composed from a finite mind and an organic body", the two substances conjoined by a special, divinely instituted relation.[9]

Clauberg not only laid the theoretical foundation of mechanical physiology at Duisburg but was also instrumental in recruiting professors of medicine committed to the new program, and forcing out those who were not. In his magisterial study of Duisburg Cartesianism, Francesco Trevisani has provided a detailed account of the symbiotic development of Cartesian natural philosophy and medicine in the careers of Tobias Andreae (1633–85) and Friedrich Gottfried Barbeck (1644–1703). Trevisani's work also makes clear that in the Duisburg school Descartes's hydraulic machine was never entirely rid of non-mechanical principles. In particular, the chemical theory of ferments as propounded by the Leiden professor Franz de la Boë, or Sylvius (1614–72), exerted a strong influence in Duisburg, as in many other universities. Unlike Descartes's account of the production of chyle, blood, and animal spirits by means of filtration, rarefaction, and the action of "a fire without light" in the heart, Sylvius's theory of fermentation

[8] CLAUBERG, Th. corp. viv. XXII. 507–510.
[9] CLAUBERG,Th. corp. viv. XXIV. 582–94: '*Res composita ex mente finita & corpore organico*'. See TREVISANI, *Descartes in Deutschland,* p. 83–99, for an outline of Clauberg's transition from physics to medicine along Cartesian lines.

grew out of the chemical tradition of Paracelsus and van Helmont. It explained basic metabolic processes by means of opposed acids and alkalis characterized by irreducible qualitative powers. Indeed, while applauding Descartes's mechanistic physiology, Sylvius also proved to be a trenchant critic of his medical theories on both methodological and substantive grounds. Following Sylvius, many professed Cartesians freely rejected Descartes's specific mechanistic speculations concerning, for instance, respiration or glandular secretion in favor of the actions of tinctures couched in terms of qualities of chemical elements.[10] As Trevisani observes in the case of Andreae, "only the [theory of] blood circulation obeys mechanical, or better thermodynamic, criteria". The rest depends on biochemical processes operating through ferments, and a kind of "*architectus* [that is] nothing other than a a manifestation of the *anima mundi*".[11]

A still more diluted appeal to Descartes appears in the later seventeenth and early eighteenth centuries in the influential work of the Halle professor Friedrich Hoffmann (1660–1742). Hoffmann has sometimes been seen as an important proponent of Cartesian iatromechanism, especially when contrasted with his equally influential vitalist colleague, Georg Ernst Stahl (1659–1734).[12] As de Ceglia has argued, however, despite his sincere admiration for Descartes's mechanical vision, Hoffmann remained rooted in the chemical approach of his teacher at Jena, Georg Wolfgang Wedel (1645–1721), and, especially after his encounter with Robert Boyle, broke sharply with Cartesian speculation in favor of the "experimental

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[10] For some of Sylvius's criticisms of Descartes, see EVAN R. RAGLAND, "Mechanism, the Senses, and Reason: Franciscus Sylvius and Leiden Debates Over Anatomical Knowledge After Harvey and Descartes", in *Early Modern Medicine and Natural Philosophy*, edited by Peter Distelzweig, Benjamin Goldberg, and Evan R. Ragland, Dordrecht, Springer, 2016, p. 173–205, esp. p. 191–200.

[11] TREVISANI, *Descartes in Deutschland,* p. 124.

[12] For a detailed study of Hoffmann's iatromechanism, see INGO WILHELM MÜLLER, *Iatromechanische Theorie und ärtzliche Praxis im Vergleich zur galenistichen Medizin*, Stuttgart, Franz Steiner, 1991.

philosophy". Hoffmann's mature physiology, de Ceglia observes, is thoroughly eclectic. He accepts both Descartes's three-element account of matter and the five-element ontology (water and earth, plus salt, sulphur, and mercury) of seventeenth-century iatrochemistry; he attributes the origin of nervous fluid to an active ether; and he identifies animal spirits with the sensitive soul, ascribing to them the power of moving themselves by choice.[13] What remains of Descartes is the mere image of the hydraulic body-machine.

An initial survey of the German medical reception of Descartes could thus leave one with the impression that Cartesian natural philosophy was largely a seductive idea for medical science, for the details of which it was deemed not truly serviceable. It was a philosopher and theologian, Clauberg, who advocated for the reform of medical theory by founding it on Cartesian physics. The *medici and physici*, however, appear never to have abandoned the anatomical and chemical traditions in which they had been trained, and only took from the new physics what would not disturb established modes of explanation. The object of this essay is challenge this impression by directing attention to a lesser-studied exponent of German medical Cartesianism who, at least in the theoretical parts of medicine, defies the dominant pattern. At Marburg, Johann Jakob Waldschmidt made perhaps the most thorough use of Cartesian physics in medical physiology. His case is also a microcosm of the complex intersections of religious, academic, and political forces at play in the Protestant German reception of Descartes.

[13] FRIEDRICH HOFFMANN, *Fundamenta medicinae*, Halle, Hübner, 1695, I. 3. 11–13; I. 5. 44–7; I. 6. 3; See FRANCESCO PAOLO DE CEGLIA, "Matter is Not Enough: Georg Ernst Stahl, Friedrich Hoffmann and the Issue of Animism", *HOPOS: Journal of the History of Philosophy of Science*, 11 (2021), p. 502–527.

2. *Waldschmidt and Marburg*

Born in Rodheim vor der Höhe, Johann Jakob Waldschmidt (1644–89) studied medicine in Prague and Vienna before returning to Hesse to earn his degree in Giessen. Already in the 1660s, he had absorbed the leading themes of Descartes's natural philosophy, likely from his reading of Cartesianizing medical and physical writers including Florent Schuyl (1619–69), Jacques Rohault (1618–72), and the Duisburg trained Theodor Craanen (1633–88).[14] He arrived in 1674 at the University of Marburg as professor of medicine, to which he added in 1682 a chair in physics. In keeping with a common practice at the Hessian court, he also served as personal physician and councilor to the Landgrave of Hesse-Kassel, alongside his friend and collaborator, Johann Doläus (1651–1707). With powerful patrons, he was able to teach and write in relative freedom. Nevertheless, toward the end of his life his enthusiasm for Cartesianism in philosophy and medicine and for Cocceianism in Reformed theology got him embroiled in controversies, from which he was extricated by his untimely death from dysentery.

Waldschmidt's brief career mirrors the turbulent history and confessional politics of the University of Marburg in the seventeenth century. Founded as a Protestant institution in 1527, the university's religious affiliation fluctuated between the Lutheran and the Reformed (Calvinist) over the next century. Around 1600, however, it had become established as a center of Reformed learning. Although technically pluralistic, inasmuch as it also housed Lutheran professors, Marburg attracted a disproportionate number of students from Calvinist communities across Central Europe.[15] Its confessional identity became official in 1605 with the conversion of

[14] FRANCESCO TREVISANI, "J. J. Waldschmidt: Medicus Cartesianus", *Nouvelles de la Republique des Lettres*, 2 (1981), p. 143–164, esp. p. 144.
[15] HEINRICH HERMELINK and SIEGFRIED AUGUST KAEHLER, *Die Universität Marburg von 1527–1927*, Marburg, Elwert, 1927, p. 216.

the Landgrave of Hesse-Kassel, Moritz the Learned, who had inherited the territories of Hesse-Marburg the previous year. Henceforth, the university assumed an important role in the program of furthering the Reformation along Genevan lines. Lutheran professors who refused to embrace Moritz's creed left and founded in 1607 the University of Giessen under the patronage of the Lutheran Landgrave of neighboring Hesse-Darmstadt. With the intellectual resources of the university now at his disposal, Moritz undertook an ambitious program of educational reform at all levels of Hessian society.[16] In 1615, he also personally dispatched his court chaplain and, from 1619, professor of theology, Johannes Crocius (1590–1659), to Brandenburg to minister to its newly converted Elector, Johann Sigismund. In medicine, meanwhile, Moritz's fascination with alchemy and hermeticism decisively remade the faculty. In 1609, Johannes Hartmann was appointed to the first dedicated chair of medical chemistry in Europe, who, in accordance with his patron's vision, advanced a vigorously Paracelsian and anti-Galenic agenda.[17]

This *Blütezeit* ended abruptly soon after the outbreak of the Thirty Years' War. In 1624, the armies of Ludwig V, Lutheran Landgrave of Hesse-Darmstadt and imperial ally, conquered Marburg. The Reformed professoriate of the university was disbanded and replaced by professors from Giessen. The remainder of the war years were a time of decay, culminating in the disastrous Hessian War of 1645–48. In the post-war reconstruction, Marburg gradually acquired a more ecumenical and less radical, though still Reformed identity. A new set of

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[16] ARND FRIEDRICH, *Die Gelehrtenschulen in Marburg, Kassel und Korbach zwischen Melanchthonianismus und Ramismus in der zweiten Hälfte des 16. Jahrhunderts*, Darmstadt und Marburg, Hessischen Historischen Kommission, 1983, p. 117–128.

[17] HERMELINK and KAEHLER, *Marburg*, p. 218; For a detailed account of the 'Second Reformation' in Hesse-Kassel, see GERHARD MENK, "Die 'Zweite Reformation' in Hessen-Kassel. Landgraf Moritz und die Einführung der Verbesserungspunkte", in *Die reformierte Konfessionalisierung in Deutschland—Das Problem der 'Zweiten Reformation'*, edited by Heinz Schilling, Gütersloh, Gerd Mohn, 1986, pp. 154–83.

statutes promulgated in 1653 exhorted faculty to avoid impassioned polemics and instead to present their views "restrainedly and reverently". While the Republic of Letters was to be granted its freedom to philosophize, it was also to be kept in check in order to prevent it from descending into the bitter conflicts of the previous decades.[18] It was in all likelihood for the sake of warding off threats to academic peace that the statutes also included a proscription on the teaching of Cartesianism. The official reasons for the ban were its method of doubt, which could lead students to atheism, and its incompatibility with Aristotle.[19]

Despite the official ban, Cartesian ideas gradually made their way to Marburg. As was the case in Duisburg, the transmission of Cartesianism here occurred as part of an unusual alliance it had forged with the Leiden theologian Johannes Cocceius's federalist (or covenantal) version of Reformed theology. As Willem van Asselt explains, the distinctive feature of Cocceius's theology is its character as Biblical exegesis as opposed to metaphysical speculation. For Cocceius, the object of theology is not so much doctrinal questions concerning the nature of the divinity but rather practical ones concerning piety and the attainment of the love of God. The means to this end is a hermeneutical approach to Scripture as an account of God's covenant with humanity in history, "an attempt to move theological theorizing from the realm of eternity to the plane of history and human experience".[20] Theologians and philosophers in the Cocceian-

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[18] HERMELINK and KAEHLER, *Marburg,* pp. 285–87.
[19] HERMELINK and KAEHLER, *Marburg,* p. 296.
[20] WILLEM J. VAN ASSELT, *The Federal Theology of Johannes Cocceius (1603–1669)*, Leiden, Brill, 2001, pp. 1–2. For Cocceius's influence on the German Reformed community in the Rhineland and its association with Cartesianism, see VAN ASSELT, *Federal Theology,* pp. 73–86, and SCHNEPPEN, *Niederländische Universitäten*, pp. 85–92, Cocceius expressed his views on Descartes in several texts, which van Asselt reviews. The Cocceianism of Duisburg's theologians is well-attested: e.g. TREVISANI, *Descartes in Deutschland*, p. 31. See THEO VERBEEK, *Descartes and the Dutch*, Carbondale, IL, Southern Illinois University Press, 1992, for a study of Descartes's reception, with especial reference to concerns of Reformed theology, in Dutch universities to which German Reformed academies looked for guidance.

Cartesian network certainly claimed doctrinal affinities between the two systems, in particular their namesakes' shared belief that philosophy and theology had separate aims—the former aimed at knowledge of nature, the latter at devotion—and thus required separate foundations. There is certainly a suggestive parallel between Cocceius's emphasis on piety and Descartes's oft-repeated scepticism about the value of scholastic theology. As Descartes remarked to Franz Burman: "Why do we need to spend all this effort on theology, when we see that simple country folk have just as much chance as we have of getting to heaven?"[21] Nevertheless, the alliance is probably better explained by external factors, above all by its advocates' common enmity toward orthodox Calvinism and its alliance with scholastic Aristotelianism.[22]

The Cocceian-Cartesian network supplied Marburg's theological faculty in the early 1670s with Reinhold Pauli (1638–82) and Samuel Andreae (1640–99), a cousin of Tobias Andreae. Pauli earned his doctorate from Heidelberg, having previously studied under Clauberg in Duisburg as well as in Groningen, Leiden, and Utrecht. Andreae took his doctorate from Basel, having also studied in the leading Reformed universities of Heidelberg and Groningen. Once in Marburg, they directed their energies neither to upholding the prohibition on Cartesianism nor at their orthodox Calvinist opponents, but rather at a Socinian revival in their shared hometown of Danzig. Cartesian natural philosophy, meanwhile, had already made its way to Marburg by the early 1660s, and was being taught by Johannes Magirus (1615–97), who had studied in Leiden and was once personal physician to Johann Sigismund's daughter, Maria Eleonora of Brandenburg.[23] Descartes would not fall under serious scrutiny until 1687, with the

[21] Conversation with Burman, AT V 176; see also, Descartes to Mesland, AT IV 119.
[22] SCHNEPPEN, *Niederländische Universitäten*, p. 89; VAN ASSELT, *Federal Theology*, pp. 81–6.
[23] See SABINE SCHLEGELMILCH, "The Scientific Revolution in Marburg", in *Early Modern Disputations and Dissertations in an Interdisciplinary European Context,* edited by Meelis

arrival of the Huguenot theologian Thomas Gautier (1638–1709) following the revocation of the Edict of Nantes. Gauthier's initial antagonist in the ensuing *Cartesianismusstreit* was his fellow Huguenot refugee, Dénis Papin (1647–1713), a mathematician and experimentalist who had collaborated with Christiaan Huygens and Robert Boyle. But the polemics quickly drew in Waldschmidt, whose position in the Hessian court further inflamed the controversy.[24]

After a cautious start, Waldschmidt had begun to teach and write with open reference to Descartes and to the by-now well-established Dutch Cartesian network. A series of disputations in the late 1670s and 1680s with Waldschmidt as *praeses* defend Cartesian theses concerning the etiology of various diseases. Chilblains (*De pernionibus*, 1687), for example, are caused by the expansion of tissue near the surface of the skin due to the stagnation of bodily fluids as a result of exposure to cold.[25] Seizures (*De stupendo affecti catalepsi,* 1678) are not, *per* the received view, caused by congelation of the animal spirits but rather by the blockage of one side of the organ of common sense, namely the pineal gland.[26] Two disputations from 1687, "*Medicus cartesianus*" and "*Chirurgus cartesianus*", lay out programmatic arguments for medical reform.

Waldschmidt's direct involvement in the Hessian controversy over Cartesianism, however, took the form of a pamphlet he authored anonymously, *Copia eines Schreibens an eine Hohe Standes-Person in Teutschland von der cartesianischen Philosophi und coccejanischen Theologi* (1687). The *Copia* was perceived as targeting the orthodox Reformed court chaplains, to whose defense rose their junior colleague Caspar Baum. The *Copia*, the response

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Friedenthal, Hanspeter Marti and Robert Seidel, Leiden, Brill, 2020, p. 288–311, esp. p. 295–296.

[24] HERMELINK and KAEHLER, *Marburg*, pp. 308–13.

[25] Disp. VI. 7-8. I cite Waldschmidt's texts from *Opera medico-practica… omnia ad mentem Cartesii*, Frankfurt-am-Main, Friedrich Knoch, 1695, using the following abbreviations: [IMR] for the *Institutiones medicinae rationalis*; [Disp.] for the *Disputationes medicae varii argumenti*.

[26] Disp. XV. 12; XV. 17-18.

(*Gegenschall*), and a counter-response (*Nachbericht… auf der Gegenschall*) were all published anonymously but the authorship of Waldschmidt and Baum was soon exposed.[27] In his polemics, Waldschmidt makes a full-throated defense of Descartes against the charges of atheism, defending his sceptical method as "*investigatio veritas*" and "*pia dubitatio*", attacking scholastic theology, and accusing his opponents of not having read Descartes's texts. He has less to say about Cocceianism, conceding that his knowledge of its theological details is imperfect. Yet, he likens Cocceius to the figure of Paul, and affirms that Cocceians and Cartesians are "good friends" in virtue of having common enemies of truth, the orthodox Calvinism represented by Gisbert Voet and its adherence, enshrined in the Marburg statutes of 1653, to Aristotelianism. The *Copia* lays bare Waldschmidt's sympathies with an anti-clerical current in late seventeenth-century German Protestantism, in whose service he recruits Descartes and Cocceius as philosophical and theological patrons.

Waldschmidt's career reflects a common pattern of German Cartesianism's entanglement in theological controversies. From his first reception in Duisburg, Descartes became caught up in internal disputes in Germany's Protestant communities. These disputes, however, ended up serving as vital conduits for the dissemination of Descartes's philosophy, especially his physics, in the universities. Duisburg's theologians had much to do with cultivating an alliance between Descartes and one divergent form of Reformed Protestantism, that of Cocceius, which ensured the survival of Cartesianism in the face of orthodox opposition. As the century wore on, growing polarization would lead to Cartesianism becoming linked to increasingly radical movements in

[27] FRIEDRICH WILHELM STRIEDER, *Grundlage zu einer hessischen Gelehrten und Schriftsteller Geschichte*, *vol. 1*, Göttingen, Barmeier, 1781, p. 290–294; HERMELINK and KAEHLER, *Marburg*, p. 304–313.

German Protestantism, once labeled "Separatism" and more recently "Radical Pietism".[28] Waldschmidt appears as a zealous participant in these currents, his advocacy of Cartesian physiology in his medical vocation conjoined in his mind with his convictions concerning the proper means to salvation. With this context in view, we can turn to his program of medical reform.

3. *Waldschmidt's physiology*

Waldschmidt presents his system of medicine in two texts: *Fundamenta medicinae* (1685), and *Institutiones medicinae rationalis* (1688). Both are based on materials drawn from his dissertations and disputations, and are similar in content. The latter is included in his *Opera medico-practica... Omnia ad mentem Cartesii* (1695; subsequent editions in 1707, 1717, 1736), together with a large collection of case studies, practical advisories (*monita*) to medical students, disputations, scholarly correspondence with Johann Doläus, an essay in German on the therapeutic benefits of tea and, intriguingly, inserted among his letters to Doläus, a copy of the vehemently anti-scholastic pamphlet, published anonymously by a medical doctor under the initials H.O.M.D, titled *Vernünfftige Gedancken über die aristotelische und cartesianische Philosophie*.[29]

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[28] For the Separatist movement in Hesse during Waldschmidt's time, see NORBERT FEHRINGER, "Philadelphia und Babel: der hessische Pietist Heinrich Horche und das Ideal des wahren Christentums", Doctoral thesis, University of Marburg, 1971. Horch (1652–1729) was the respondent in a disputation under Waldschmidt (*De venenis pestilentialis*, 1675). See FRANCESCO TREVISANI, "Studi sul cartesianesimo tedesco: Johann Jacob Waldschmidt", *Annali dell'Istituto storico italo-germanico in Trento*, 17 (1991): 187–223, for an examination of Waldschmidt's place at the intersection of Cartesianism and German Pietism. See also, HANS SCHNEIDER, "Der radikale Pietismus im 17. Jahrhundert", in *Geschichte des Pietismus* Bd. 1, edited by Martin Brecht, Göttingen, Vandenhoeck & Ruprecht, 1993, pp. 391–439.

[29] To my knowledge, neither the identity of the author nor its precise publication date have yet been established. The Wolffenbüttel Bibliothek proposes a publication year around 1650.

Waldschmidt's *Institutiones* is structured in the manner of a traditional medical textbook. A chapter on the object and end of medicine is followed by separate parts on physiology, pathology, semiotics (diagnostics and prognostics), hygiene, and therapy. Medicine is conceived as the "*ars* sive *scientia*" of the complete human body. It is an art insofar as it includes the work of the surgeon and of the pharmacist; it is a science inasmuch as the causes of disease are explicated through philosophical principles. Medicine has as its object "both of contemplation and of application, the state of the living human being or the living human body".[30] Waldschmidt calls for reform in both the theoretical and practical aspects of medicine. It is in the former, however, that his innovations appear most distinct.

Surveying the history of the discipline, Waldschmidt identifies six medical sects: the "empiric" (the ancient Egyptians); the "dogmatic or rational" (Hippocrates and Galen); the "methodical" (which he associates with the Paduan physician Ercole Sassonia (1551–1607)); the "Spagyrical, chemical, hermetical, Paracelsist" in which he also includes van Helmont and Sylvius; a mixed "dogmatico-hermetical" school; and finally, the new "dogmatico-mechanical" sect of Descartes and Gassendi. Waldschmidt aligns with the last camp, emphasizing its importance for advancing medicine as a science, that is, as an inquiry into causes. Indeed, Descartes is referred henceforth simply as *Philosophus*. Accordingly, "*Oeconomia animalis*", the label for medical physiology popularized by Dutch Cartesian doctors, "is to be explained by motion and figure, and we should admit nothing that we cannot perceive clearly and distinctly

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HANSPETER MARTI, "Aristoteles und Descartes", in *Reformierte Orthodoxie und Aufklärung,* edited by Hanspeter Marti and Karin Marti-Weissenbach, Cologne, Böhlau, 2012, pp. 147–164, suggests that it was published around 1700. The pamphlet's inclusion in Waldschmidt's posthumously published *Opera omnia* raises but does not settle the question of his authorship.

[30] IMR I. 1. 5–7: "*Objectum* tum contemplationis tum applicationis, est statua humana vivens sive corpus humanum vivens".

through the force of mechanical principles".[31] Waldschmidt further defends a view of the human body as a clockwork or automaton against its detractors, who object that it makes it impossible to account for life, and for the nourishment and growth of the body. To that end, he turns to Descartes's metaphysics of substance. For Waldschmidt, the human being should be understood as composed of two distinct substances, a *substantia cogitans* and a *substantia extensa*, each of which contributes separately to life and health. "The life and activity of the former consists in *thinking*; that of the latter in *extension* modified in a certain way".[32] That is, each substance has its own conditions that conduce to life: thought in the former, and certain patterns of motion in *res extensa* that make some bodies but not others count as living. The whole human being results from the two substances being "conjoined under fixed laws by God", such that "certain corporeal motions, especially in the pineal gland of the brain, are followed by certain thoughts in the mind", and vice versa. Human life consists in the mutual commerce of the two substances, death in its cessation.[33] For Waldschmidt, it is crucial not to confuse the states attributed to each kind of substance and, from the standpoint of physiology, to regard the body strictly as a "*Machina hydraulico-pneumatica*". The practical end of medicine, or healing, can then be framed as the restoration of the fragile structure of the machine when it is damaged.[34]

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[31] IMR I. 1. 3: "Quod Oeconomiam animalem per motus & figuram interpretemur, nihilque admittamus, quod non clare & distincte vi principiorum mechanicorum percipere possimus".
[32] IMR I. 1. 8: "Illius vita & esse actuosam consistit in *cogitatione*; hujus vero in *extensione* certo modo modificata".
[33] IMR I. 1. 8: "Tandem cum duae haec substantiae certis sub legibus a Deo sint conjunctae, & certos motus corporis & praesertim cerebri ejusque glandulae pinealis sequi debeant certae cogitationes mentis, & vicissim certas cogitationes mentis certi motus corporis, hominis sive totius compositi vita in mutuo hoc commercio ponitur, mors vero in cessatione totali".
[34] IMR I. 1. 9-10: "*Finis* Medicinae est *mederi*, & fragilis hujus machinae fabricam quantum in artis est potestae sartam tectamque servare, aut fractam & labefactatam resarcire & in integram restituere".

Waldschmidt rests his physiology on a new theory of elements borrowed from Descartes (at *Principia philosophiae* III.52). He supposes that God divided *substantia extensa* into three kinds of corpuscles— *prima*, *secunda*, and *tertia*. To the first kind belong corpuscles of indefinite motion, figure, and magnitude moving at high speed, which can fill up any space whatsoever, and which compose lucid bodies. The second kind of corpuscle is of determinate figure and magnitude and composes pellucid bodies, or those that can transmit light. The third kind of corpuscle is the least apt for motion, of an angular shape, opaque, and the dominant component of terrestrial bodies. The metabolically significant phenomena of fermentation and effervescence are principally explained in terms of the arrangements of corpuscles of the third kind. Besides these three, there are no other basic divisions in matter: "the world of bodies is exhausted by *lucid, pellucid, and opaque*, or *light emitting, light transmitting, and light reflecting* bodies".[35] All other corporeal properties should be reducible to differences in the proportions and arrangement of the three kinds of corpuscle of which they are composed. Waldschmidt dismisses competing theories of matter. The four Aristotelian elements are better treated as mixed bodies resulting from Descartes's three elements. The same goes for the various chemical taxonomies in the Paracelsian tradition. Least of all should we accept van Helmont's privileging of water as the single element into which all others resolve.[36]

Waldschmidt is happy to retain certain chemical notions employed by iatrochemists, in particular the division of salts into acids and alkali. In the chemical tradition, the acid/alkali division underlies various "composite natures", including the secretions of organs that account

[35] IMR I. 2. 2: "Quandoquidem totum hoc universum corporibus *lucidis, pellucidis & opacis,* sive *lucem emittentibus, lucem transmittentibus, & lucem remittentibus,* exhaustitur".
[36] IMR I. 2. 3–5. Waldschmidt's characterization of van Helmont is clearly uncharitable, but we need not examine the details here.

for metabolic processes and whose deviations from normal function are associated with disease. But Waldschmidt insists that the concepts of acid and alkali are merely descriptively useful, and that their causal roles in health and disease must be traced to the fundamental properties of matter. He does not shy away from speculation concerning the details of the latter. Acids, he supposes, are "rigid bodies, oblong in figure, resembling gladioli". Alkali, by contrast, are "rigid bodies more or less tapering in shape but more porous".[37] What grounds the strong correlations between phenomena described as effervescence or fermentation and the processes attributed to the activity of acids and alkali, for Waldschmidt, are differences in shape, porosity, and the relative speeds of interacting corpuscles and the characteristics of the organ tissue from which they are secreted and into which they are taken up. Only under this theoretical axiom of the dogmatico-mechanical school does Waldschmidt admit operational definitions of concepts whose utility in diagnosis and treatment is well-established, such as the divisions of salts into relatively more fixed or volatile, manifest or occult, acrid or corrosive.[38]

The reductionist approach extends to the theory of bodily fluids and their roles in the functions of nutrition and growth as well as sensation and movement. Waldschmidt's physiology thus elaborates Descartes's project of mechanizing both the vegetative and the sensitive souls of the Galeno-Aristotelian tradition.[39] Chapters 3 and 4 (*De chylo et sanguine; De spiritibus*) describe the process of bodily nourishment: the mastication of food by the teeth, the effect of saliva to ease its propulsion down the gullet, its refinement into chyle once it comes into contact

[37] IMR I. 2. 7: "Describitur autem sal *acidum* quod sit corpus rigidum, figurae oblongae, gladiorum instar... Sal *alkali* autem est corpus rigidum plus minus acuminatum, sed magis porosum".
[38] IMR I. 2. 8.
[39] See GARY HATFIELD, "Mechanizing the Sensitive Soul," in *Matter and Form in Early Modern Science and Philosophy*, edited by Gideon Manning, Leiden, Brill, 2012, p. 151–186.

with acidic matter in the stomach, the concoction of chyle into blood and lymph in the liver, the still further rarefaction of blood by the heat of heart to produce spirits whose separation from the blood in the mid-brain yields the animal spirits, which then mediate sensory and motor functions. "All this work is merely mechanical", he declares.[40] The key principles underwriting these metabolic processes include, first, the differential porosities of the matter composing organs, glands, and vessels, resulting in the filtration of corpuscles of differing sizes, shapes, and speeds; and second, the action of heat, notably in the heart, that accelerates the filtration process by rarefying blood to produce what the medical tradition calls "vital spirits". Rarefaction is conceived in the manner of Descartes, not as the action of a separate ethereal substance displacing matter, but of finer, faster moving corpuscles of the same type flowing in to occupy interstitial spaces in the structure of a solid body.[41] The liquid that flows out of the pulmonary artery to the lungs and then to the rest of the body contains vital spirits, which are nothing but the subtler parts of the blood. The separation of these spirits occurs in the brain, as Waldschmidt explains citing Descartes's *Les passions de l'âme*, I, article 10. When the arterial fluid hits upon the brain surface, its subtlest and fastest moving particles enter the brain cavities, and are then called animal spirits, though they are not different in nature from blood, lymph, chyle or any other material body.[42] These finest of the bodily fluids flow into tubes leading to the external sense organs, whence by means of their motions they relay information about the external world to the internal senses of memory, imagination, and the common sense.

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[40] IMR I. 3. 2: "Totum autem hoc negotium mere mechanicum est". Waldschmidt's description parallels Descartes's in *Traité de l'homme*, AT XI. 121–2.
[41] IMR I. 3. 12–13; cf. DESCARTES, *Principia philosophiae* II, art. 6, AT VIII-1 43.
[42] IMR I. 4. 5.

Following Descartes, Waldschmidt casts the functions of the sensitive soul in mechanistic terms. The *sensorium commune*, which receives motions from all the external organs, is identified with the pineal gland; *phantasia* is a "certain radiation of the animal spirits… upon the pineal gland"; and memory consists in impressed brain traces, which, when flush with animal spirits, give the mind occasion to recall past thoughts.[43] The immaterial mind enters the picture at the pineal gland to interpret the patterns formed by the course of the animal spirits and to redirect them according to its appetites. Nourishment, for example, occurs because violent agitations caused by food scraps tumbling about in an otherwise empty stomach are conveyed through the nerve fibers to the pineal gland, where they give occasion to the mind to conceive the idea of hunger.[44]

Waldschmidt adopts a simple occasionalist model to account for mind-body interaction at the pineal gland. He divides the process into three stages: reception, perception, and judgment. Receptivity is attributed solely to the body, and consists in nothing other than the motion of bodily fluids arising from impingements upon the external sensory organs. These motions occasion in the mind perceptions of the state of the body, which are then followed by judgments of benefit or harm.[45] Waldschmidt shows no interest, however, in exploring the conceptual

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[43] IMR I. 4. 14: "*Sensorium commune* quod omnium sensuum externorum motus recipit, est *glandula pinealis*... *Phantasia* est certa spirituum animalium radiatio, sive certa illorum cursus forma, super glandulam pinealem… *Memoria* consistit in vestigiis cerebro impressis, unde si spiritus animales in eadem incidunt, eandem suscipiunt cursus formam, cujus occasione menti priores occurrunt cogitationes".

[44] IMR I. 3. 1: "Cibi reliquiae, vacuo in ventriculo hinc inde oberrantes, mora & agitatione acriores factae, superius ventriculi orificium ex fibrillis nerveis contextum vellicant, ex cujus motus occasione, mediantibus nervis ad sensorium commune… delati, mens ideam *famis* concipit, atque de cibo sumendo cogitat, qui cogitationis modus *appetitus* nomine venit".

[45] IMR I. 4. 8: "*Receptio* nil nisi motus est, attributum solius corporis, quia tamen in nobis praeter corpus alia quoque est substantia cogitans, occasione motuum certas habens cogitationes & percipere & judicare nunquam in corpus, sed in mentem cadunt, sensus in homine ad totum spectant compositum, eumque in finem illi dati sunt, ut horum opesciat, quae sibi sint commoda

problems arising from occasionalism about mind-body interaction, or concerning causation in general in the Cartesian framework. Given his broad familiarity with contemporary Cartesian occasionalists who dealt with these issues—Géraud Cordemoy, Jacques Rohault, and Pierre-Sylvain Régis, for instance, are regularly cited in his work—we may surmise that he simply deemed the metaphysical questions as not directly relevant to his audience of medical students. His approach resembles that of other Cartesian doctors such as Craanen, as well as physicists such as Rohault and Régis, who adopt occasionalism as a working hypothesis for mind-body interaction while continuing to treat bodies as real causes of effects in other bodies. Waldschmidt's energies are directed toward deploying Cartesian natural philosophy in medicine rather than examining its metaphysical foundations.[46]

Accordingly, Waldschmidt's medical etiology assumes that bodies possess powers to produce determinate effects in other bodies. Here again, his approach displays a renovation of existing medical concepts guided by the new natural philosophy. In Book II (*Pathologica*) of the *Institutiones*, he classifies the efficient causes of disease under the traditional rubric, namely the six *non naturales*; the condition of *plethora*, or an overabundance of blood; *cacochymia*, a broad class of ill-humours; poison; and the peregrinous aether. The category of *non naturales* comprises external factors known to play a role in health and disease: air, food and drink, sleep and waking, exercise and rest, the *excreta* and *retenta*, and the *pathemata,* or accidents of the soul, which roughly correspond to the modern category of emotions. Waldschmidt notes the

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vel incommoda, utilia vel noxia". Waldschmidt's discussion corresponds to Descartes's three-stage model in *Sixth Replies*, AT VII 436–437.

[46] In this regard, we may note his contrast with Clauberg. While Clauberg is an equally enthusiastic advocate of Cartesian physiology in medicine, his primary vocation is that of a metaphysician and theologian, and his natural philosophy culminates in a lengthy treatise on the mind-body problem, *Corporis et animae in homine conjunctio* (1664).

peculiarity of the label "*non naturales*", inasmuch as none of the items in the list relate to bodies other than as natural or physical things.[47] Yet, he retains the terminology, and subsequent chapters summarize received wisdom concerning the relevance of diet, sleep, and physical activity for disease.

This outwardly standard presentation of pathology departs importantly with respect to the sixth category of the *non naturales*, the accidents or passions of the soul. Galenic doctors had placed these among the non-naturals inasmuch as they were conceptualized as occurrences external to the person, or not determined by the natural composition of the body. The *pathemata* were first imprinted on the soul and then on the body, where they gave rise to characteristic physiological effects described as, for instance, the boiling of blood, or excess production of bile.[48] By contrast, Waldschmidt adopts Descartes's definition of the *passionibus animi* (from the Latin translation of *Les passions de l'âme*, I.27) as, "those perceptions, sensations, or agitations of the soul, which are particularly referred to it, and which are produced, conserved, and strengthened by some movement of the animal spirits".[49] For Waldschmidt, Descartes's definition implies that the production of passional states involves other fluids as remote causes, before the animal spirits forming at the pineal gland occasion sensations in the soul. For in the natural state of the body, blood, lymph, and spirits press upon one another, and it follows that, in a passional episode, the state of the whole body is implicated, and can thus be altered and

[47] IMR II. 4. 2–3.
[48] For an account of the theory of the *pathemata* in Galen, Avicenna, and their reconcilers, see NAAMA COHEN-HANEGBI, "A Moving Soul: Emotions in Late Medieval Medicine," *Osiris*, 31 (2016), p. 1–21.
[49] IMR II. 10. 1: "*Perceptionem, sensationes aut commotiones animae, quae ad eam speciatim referuntur, quaeque producuntur, conservantur & corroborantur per aliquem motum spirituum animalium*". Note: Waldschmidt interpolates '*animalium*' here in quoting the Latin text of the *Passiones animae*.

disturbed, especially if the bodily changes are indulged by dwelling upon them.[50] An episode of sadness or grief (*tristitia & moerere*), for instance, is characterized by blood flowing sparingly from the heart, a slow pulse, feeble respiration, and chylification growing weak. These physiological phenomena, however, are not simply accompaniments or effects of external factors directly impacting the soul, but rather remote efficient causes of the production or maintenance of a state of sadness. Weaker blood flow and changes in digestion modify the patterns of animal spirits flowing on the surface of the pineal gland, which gives rise to or sustains melancholic sensations.[51] The internal activity of the soul, in turn, can play a role in determining the strength, duration, or cessation of the bodily syndromes involved in passional episodes. In this way, the dual sources of life and activity, mind and body, play distinct causal roles in the state of the whole human being.

The foregoing is a sketch of how Waldschmidt systematically implements the Cartesian idea of the human body as a hydraulic machine in his physiology and pathology. A key feature of his program is the dissolution of the relatively clear boundaries between the core physiological and pathological categories of the Galenic and the more recent chemical traditions: elements, complexions, humours, and the chemical principles of van Helmont or Sylvius. The hydraulic machine and all its parts are composed of a uniform kind of matter in terms of which the explanatory roles previously attributed to humours and complexions, acids and alkalis, must be recast as at best operationally useful notions. He conceives physiological facts as fully reducible to the relative speeds of fluid particles, their densities and porosities, and their differential uptake in various organs. The body-machine is stripped of faculties and powers as well as chemical

[50] IMR II. 10. 2.
[51] IMR II. 10. 3.

ferments, and joined only to an immaterial soul that governs it in light of its ends, among which the preservation of health and the prolongation of life are the main concern of the *medicus*. In brief, Waldschmidt the physicist and physiologist seeks a broad overhaul of medical theory along Cartesian lines. We may further ask: what lessons does Waldschmidt the medical practitioner learn from Descartes?

4. *Medicus cartesianus?*

As was common in many universities, Waldschmidt taught both medicine and natural philosophy. He viewed physics as necessary preparation for the work of a medical doctor. We have seen some respects in which he brought Cartesian natural philosophy to bear on medical physiology and pathology. His ambition to extend this agenda to the applied parts of medicine is exemplified in a pair of disputations from 1687, *Medicus cartesianus* and *Chirurgus cartesianus*. These two programmatic documents set out a case for urgently needed reform in regimens for the diagnosis (*Semiotics*), conservation (*Hygiene*) and restoration (*Therapy*) of health. Social and technological constraints, however, meant that Waldschmidt's medical practice largely remained in step with established procedures.

Medicus cartesianus, as scholars have noted, is a largely polemical exercise aimed at defending a corpuscular theory of disease and, further, at promoting *libertas philosophandi* in medicine.[52] Waldschmidt rails against the errors that have been introduced in medicine due to faulty physical theory. His principal target is the Galenic model of explaining disease in terms of humoural imbalances and recommending treatment based on opposed qualities of hot/cold and dry/moist. Waldschmidt advocates instead for the greater explanatory power of the mechanical

[52] TREVISANI, *Medicus cartesianus*, p. 140; SCHLEGELMILCH, *Revolution in Marburg,* p. 303–4.

framework and, as a consequence of better causal understanding of disease, its potential for improved treatment. The disputation concludes with a list of specific errors "resulting from the ignorance of animal economy and the mechanical philosophy", such as that melancholy is due to an enlarged spleen; prescribing cold foods for treatment of fevers; or that kidney stones are cured by diuretics.[53] *Chirurgus cartesianus,* defended by Waldschmidt's son Wilhelm Hulderich, is likewise rich in polemic, demanding that surgeons become informed about the Cartesian theory of blood circulation, and concluding with the promise of the iatromechanical framework for surgical intervention. What neither disputation offers is much in the way of detail concerning alternate prescriptions and practices.

In fact, attention to the remaining parts of Waldschmidt's *Institutiones* reveals a large gap between the promise of Cartesian physiology and the contemporary realities of medicine. Despite his rigorously mechanistic approach to the former, diagnosis and prognosis rest on a congeries of earlier practices. Qualitative examinations of urine, feces, and pulse remain the principal tools for interpreting the state of the body, for which traditional authorities provide hermeneutical guidance. Waldschmidt's catalogue of prognostic signs likewise draws overwhelmingly on the Hippocratic corpus.[54] Medical astrology also features among his prognostic tools. A sudden change in the course of disease (*crisis*), for instance, is interpreted by means of factors such as the influx of the moon and its conjunction or opposition with other planets.[55] Waldschmidt's recommended treatments similarly draw on standard *materia medica*. His disputations confirm this character of his work. One on kidney stones criticizes the standard

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[53] *Medicus cartesianus*, Thes. XIII: "Sed ne partium studio laborare videar, catalogum hunc errorum intuere, hactenus ex ignoratia oeconomiae animalis & Philosophiae mechanicae commissorum".
[54] IMR III. 2–6.
[55] IMR III. 9. 9.

prescription of diuretics based on the theory, which he rejects, that stones are caused by the coagulation of urine in the kidneys. His alternate treatments, however, are aimed at pain management during the passing of stones for which he prescribes an analgesic made from various herbs, honey, and scorpion flesh.[56] Among his disputations is one devoted entirely to the preparation and use of *theriaca coelesti*.[57] In brief, the impact of Descartes on Waldschmidt's medicine is inevitably limited to the mechanical framework for its account of physiology and anatomy, to theory rather than to praxis. Technological constraints and the need to meet the historically conditioned expectations of patients and practitioners beyond the academic setting meant that little changed on the ground. One innovation in hygiene that Waldschmidt does trumpet—the benefits of tea and tobacco for keeping the blood, lymph, and spirits nimble and agile—has only the barest connection to Cartesian physiology.[58]

Waldschmidt's career encapsulates the various cultural currents among which Cartesianism flows in Protestant Germany. Descartes appears among the neoteric *medici* not only as a natural philosopher but also as an ally in heterodox movements within the German Reformed community. These grew particularly radical toward the end of the century, and it is difficult not to suspect that Waldschmidt's religious sympathies, and the circumstances in Hesse in the 1680s, contributed to his further entrenchment in the Cartesian camp. His programmatic disputations as well as his correspondence with Johann Doläus display a feverish optimism, echoing the millenarian universal reform movements of the early seventeenth century. His

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[56] Disp. XXVI. 21.
[57] Disp. XI.
[58] Waldschmidt devotes an essay to the health benefits of tea, specifically for soldiers on the battlefield: "*Gründlicher Bericht, wie ein jeder dem seine Gesundheit lieb ist das Thee nicht allein zu hause gebrauchen sondern wie auch ein Soldat sich im Felde darmit praeserviren könne. Auch ob und was für Medicamenta bey dem Thee-Wasser nöthig seyen*". Cornelis Bontekoe is Waldschmidt's likely inspiration for this opinion.

physiology conveys a thoroughgoing embrace of Descartes's mechanical model of the human body. More than most other Cartesian medical doctors of the century, Waldschmidt strives to rid physiology and anatomy of humours and chemical elements as part of a broad attack on the scholastic establishment and its perceived alliance with Reformed orthodoxy. Yet, for him as for his fellow doctors, the promise of medical Cartesianism meets its limits in the face of the exigencies of medical practice. As *medicus*, Waldschmidt moves with the times.