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Temperament and the Senses: The Taste, Odor and Color of Drugs in Late-Renaissance Galenism

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Abstract

According to the medical tradition, the temperament of bodies came from the balance of their primary qualities – hot, cold, dry, and moist. However, physicians associated additional sensory properties with temperament in the field of pharmacology. These sensations included taste, color, and odor, which allow an appraisal of the constitution and active powers of drugs. The present paper examines this theme in late-Renaissance medicine, through the accounts of the French physician Jean Fernel (ca. 1497–1558) and the Italian physician Andrea Cesalpino (1519–1603). As will be shown, their respective interpretations of drug "faculties" offered original views on the relationship between temperament, sensory properties, and matter theories. Such discussions, in turn, revealed the Renaissance reception of Arabic-Latin pharmacology, Galenic medicine, and the Aristotelian physics of matter and form.

Keywords

Fernel – Cesalpino – Galen – Aristotle – Avicenna – Averroes – medicine – pharmacology – elements – matter – substance – qualities – humors – body – hylomorphism

1 Introduction

From Antiquity to the early modern period, Galenic physicians highlighted the notion of temperament in the constitution of all natural beings, including the human body, food, and drugs.[1] Also called *complexio*, the temperament resulted from the mixture of four primary qualities – hot, dry, cold, and moist. However, other qualities were also explored in the medical debates on temperament, mostly through a series of sensory properties. Coined as "secondary qualities" in Aristotelian natural philosophy, these sensory features comprised taste, odor, and color.[2] As historians have shown, Galenic physicians widely relied on these sensations to examine the patient's symptoms, bodily fluids, and environment.[3] But this appeal to the senses has mostly been surveyed in the case of Galenic therapy. The role of the senses in other branches of medicine remains to be explored. In this regard, Galenic pharmacology was a particularly significant field for understanding the relationship between temperament and the senses.

The Galenic texts on drugs, indeed, were remarkable for discussing the constitution of bodies according to an extended set of qualities. In Galen's *On Simple Drugs*, this theme was framed in a systematic study on the active powers of "simple" drugs, namely single ingredients of vegetal, animal, or mineral origin.[4] In the Middle Ages, Arabic-Latin authorities such as Avicenna (Ibn Sīnā) and pseudo-Mesue made decisive contributions on this theme.[5] Most notably, they discussed to what extent taste, odor, and color were relevant for assessing drug powers in relation to their *complexio*, their material texture, and

1 See Nancy G. Siraisi, *Medieval and Early Renaissance Medicine: An Introduction to Knowledge and Practice* (Chicago, IL, 1990), 97–114.

2 Robert Pasnau, "Scholastic Qualities, Primary and Secondary," in *Primary and Secondary Qualities: The Historical and Ongoing Debate*, ed. Lawrence Nolan (Oxford, 2011), 41–61.

3 See William F. Bynum and Roy Porter, eds., *Medicine and the Five Senses* (Cambridge, 1993); Faith Wallis, "Medicine and the Senses: Feeling the Pulse, Smelling the Plague, and Listening for the Cure," in *A Cultural History of the Senses in the Middle Ages*, ed. Richard G. Newhauser (London, 2014), 133–152.

4 For Galen's *On Simple Drugs*, I refer to Kühn's edition: Galen, *De simplicium medicamentorum temperamentis ac facultatibus* (Leipzig, 1826), vol. XI, 379–892 and vol. XII, 1–377. See Matteo Martelli, Caroline Petit and Lucia Raggetti, "Introduction: New Perspectives on Galen's Treatise *On Simple Drugs* and the History of Pharmacology," *Archives Internationales d'Histoire des Sciences*, 70 (2020), 6–15; Paula De Vos, *Compound Remedies: Galenic Pharmacy from the Ancient Mediterranean to New Spain* (Pittsburgh, PA, 2021), 19–67.

5 On the thirteenth-century Italian physician identified as Mesue (Ibn Māsawayh), see Paula De Vos, "The 'Prince of Medicine': Yūhannā ibn Māsawayh and the Foundations of the Western Pharmaceutical Tradition," *Isis*, 104 (2013), 667–712.

their substance.[6] Renaissance physicians continued these debates by expounding the types of drug "faculties" (*facultates*).[7] In so doing, they emphasized the connection between the active powers, sensory properties, and temperament of bodies in light of Galen's *On Simple Drugs*. The newly printed version of this treatise had been available in Latin from 1490 and in Greek from 1525.[8]

In studying the temperament and sensory properties of drugs, Renaissance physicians gave a closer look at their composition. Drugs were considered as 'mixtures' stemming from the union of the elements and the blending of their qualities. From the Middle Ages, this scheme had opened onto debates on temperament according to the Aristotelian physics of matter-form. What was at stake, for physicians, was the matter and the substantial form of bodies, as well as their relationship with the terrestrial and celestial realms. Interestingly, Galenic pharmacology gave an original treatment of this set of questions.[9] The prospect of testing led physicians to address the role of the senses in knowing the temperament and the microstructure of drugs. It was in this epistemic framework that physicians discussed how taste, odor, and color could give insights into the otherwise inaccessible composition of drugs into the elements.

In this article, I propose to explore some late-Renaissance theories on the temperament and composition of drugs. This period, indeed, was a crucial moment for the emergence of alternate views on the role of the senses in medical knowledge and practice. As observed in the recent research, early modern chymical medicine claimed to introduce taste as a new way of determining the active powers of bodies. Such an "empirical" approach supposedly went beyond the traditional method based on the primary qualities.[10] However, the

6 Iolanda Ventura, "Classification Systems and Pharmacological Theory in Medieval Collections of *Materia Medica*," in *Classification from Antiquity to Modern Times: Sources, Methods, and Theories from an Interdisciplinary Perspective*, ed. Tanja Pommerening and Walter Bisang (Berlin, 2017), 101–166.

7 Andreas Blank, "Pharmacology in the Renaissance," in *Encyclopedia of Renaissance Philosophy*, ed. Marco Sgarbi (Cham, 2018), 1–9, <https://doi.org/10.1007/978-3-319-02848-4_1104-1>.

8 Iolanda Ventura, "Galenic Pharmacology in the Middle Ages: Galen's *On the Capacities of Simple Drugs* and its Reception between the Sixth and Fourteenth Century," in *Brill's Companion to the Reception of Galen*, ed. Petros Bouras-Vallianatos and Barbara Zipser (Leiden, 2019), 393–433.

9 Robert J. Hankinson, "Substance, Element, Quality, Mixture: Galen's Physics and His Hippocratic Inheritance," *Aitia: regards sur la culture hellénistique au XXI^e siècle*, 7 (2017), <https://doi.org/10.4000/aitia.1863>; Abraham D. Stone, "Avicenna's Theory of Primary Mixture," *Arabic Sciences and Philosophy*, 18 (2008), 99–119.

10 See Evan R. Ragland, "Chymistry and Taste in the Seventeenth Century: Franciscus Dele Boë Sylvius as a Chymical Physician Between Galenism and Cartesianism," *Ambix*, 59 (2012), 1–21.

late-Renaissance discussions on Galenic pharmacology offer a different perspective on this claim.[11] When it came to the assay of drug powers, physicians encompassed additional senses, which they articulated with the notion of temperament. As will be argued, taste played a central role in their argument and opened on to the role of reason and experience in pharmacological method.

My investigation will concentrate on two contrasting views on the properties of simple drugs. First, I will examine the pharmacology of a major medical figure in early modern medicine, the French physician Jean Fernel (ca. 1497–1558). His *Therapeutices* ("Therapeutics"), which was part of the 1567 *Universa medicina*, was several times reedited and translated into French in the seventeenth century.[12] This treatise provided a didactic synthesis of Galenic pharmacology, in which he also expressed Platonic views on the celestial properties of substances. As Giancarlo Zanier and Hiro Hirai have shown, such a Platonic perspective on Galenic medicine was rooted in the appeal of ancient wisdom and the Christian philosophy of Marsilio Ficino and Pico della Mirandola in the Renaissance.[13] In Fernel's works, the celestial part of the body was amply expounded in *De abditis rerum causis* ["On the Hidden Causes of Things"] (1548), which will also be examined in the present study.[14] As a counterpoint to Fernel's Platonic stance, the pharmacological views of the Italian physician Andrea Cesalpino (ca. 1524–1603) will be addressed in the second section of this article.[15] Famous for his Aristotelian account of botany in *De plantis* (1583), Cesalpino provided a synthesis on Galenic pharmacology in *De*

11 See Saskia Klerk, "The Trouble with Opium: Taste, Reason and Experience in Late Galenic Pharmacology with Special Regard to the University of Leiden (1575–1625)," *Early Science and Medicine*, 19 (2014), 287–316.

12 On Fernel, see Linda Deer Richardson, *Academic Theories of Generation in the Renaissance: The Contemporaries and Successors of Jean Fernel (1497–1558)* (Cham, 2018), 153–170; Hiro Hirai, *Medical Humanism and Natural Philosophy: Renaissance Debates on Matter, Life and the Soul* (Leiden, 2011), 46–79; John Henry, "'Mathematics Made No Contribution to the Public Weal': Why Jean Fernel (1497–1558) Became a Physician," *Centaurus*, 53 (2011), 193–220.

13 See Giancarlo Zanier, "Platonic Trends in Renaissance Medicine," *Journal of the History of Ideas*, 48 (1987), 509–519; John Henry and John Forrester, "Jean Fernel and the Importance of his de Abditis Rerum Causis" in *Jean Fernel's On the Hidden Causes of Things: Forms, Souls, and Occult Diseases in Renaissance Medicine*, ed. John Henry and John Forrester (Leiden, 2004), 3–65.

14 Jean Fernel, *De abditis rerum causis*, in Henry and Forrester, *Jean Fernel's On the Hidden Causes of Things*, 105–736.

15 On Cesalpino, see Carlo Colombero, "Il Pensiero Filosofico di Andrea Cesalpino," *Rivista Critica di Storia della Filosofia*, 32 (1977), 269–284; Walter Pagel, "The Claim of Cesalpino and the First and Second Editions of his *Peripatetic Questions*," *History of Science*, 13 (1975), 130–138; Kristian Jensen, "Description, Division, Definition: Caesalpinus and the Study of Plants as an Independent Disciplines," in *Renaissance Readings of the Corpus Aristotelicum*, ed. Marianne Pade (Copenhagen, 2001), 185–206.

medicamentorum facultatibus ["On the Faculties of Drugs"] (1593) and, more concisely, in *Quaestiones medicae* ["Medical Questions"] (1593). As a well-versed physician in botany and mineralogy, he offered a significant account of sensory properties by relating them to Aristotelian natural philosophy. In his medical works, Cesalpino applied to Galenic pharmacology a stream of Aristotelian discussions on matter and form that were flourishing in sixteenth-century Italy, from Pomponazzi to Zabarella.

Whereas Fernel's and Cesalpino's views do not exhaust all the possible interpretations of drug powers in the late Renaissance, they will serve to delineate the various sources and arguments about the temperament and sensory properties of drugs. Whether in a Platonic or Aristotelian framework, both physicians offered insight into the late-Renaissance reception of Galen's *On Simple Drugs* and the Arabic-Latin sources on this subject, mostly from Avicenna and Averroes (Ibn Rushd).[16] In this regard, the present article aims to provide new findings on Averroes's conception of drug powers and its reception in late-Renaissance medicine, which have escaped the attention of historians. More broadly, it will be shown that the ancient and medieval sources of pharmacology stimulated Fernel's and Cesalpino's conceptions of taste, color, and odor in relation to the temperament of bodies.

2 Mixture and Celestial Influence: Fernel's Pharmacology

With his *Therapeutices*, Fernel aimed to provide a clear synthesis of the previous literature on Galenic pharmacology.[17] At first sight, he expressed his ethos as a Renaissance physician by emphasizing the authority of Galen and Hippocrates, while making a few denigrating remarks about "Arab" physicians. Yet, his interpretation drew largely on medieval explanations of drug powers, mostly from Avicenna, Averroes, and pseudo-Mesue.[18] The Arabic-Latin heritage, in particular Avicenna's *Canon*, was evident in Fernel's pharmacology. In its structure, his *Therapeutices* encapsulated the topics addressed in the *Canon*, namely generalities on drugs, bloodletting, and purgation, as well

16 For Avicenna's *Canon* and Averroes's *Colliget*, I refer to the following editions: Avicenna, *Avicennae Arabum medicorum principis. Canon medicinae*, 2 vols. (Venice, 1595); and Averroes, *Colliget libri VII* (Venice, 1574).

17 Jean Fernel, *Therapeutices universalis seu medendi rationis libri septem*, in *Universa medicina* (Paris, 1567), 344–557.

18 See Dag Nikolaus Hasse, *Success and Suppression: Arabic Sciences and Philosophy in the Renaissance* (Cambridge – London, 2016), 137–178.

as an exposition of simple and compound drugs.[19] Fernel examined simple drugs according to a series of questions: their powers, taste, measure, preparation, and combination into compound drugs. Overall, he aimed to offer a clear explanation of medication and therapy to learned practitioners, while supplying a concise account of drug powers. On this point, Fernel followed Galen's pharmacology, which was summarized in the third book of *On Mixtures*, and elaborated in the first five books of *On Simple Drugs*.[20]

Before examining Fernel's interpretation, it is important to recall that the properties of drugs were not described in terms of numbered faculties in Galen's *On Simple Drugs* and Avicenna's *Canon*, but as types of powers. In the late Middle Ages, Averroes's *Colliget* and the *De simplicibus* of pseudo-Serapion (Ibn Sarābiyūn) summed up the Galenic theory of drug powers by delineating a series of "virtues" (*virtutes*) and "operations" (*operationes*). As will be argued, Renaissance physicians reformulated this classification according to several faculties. I shall now examine this framework in Fernel's pharmacology before going further into the question of drug taste, odor, and color.

2.1 *Temperament, Matter and Form*

Renaissance theories of drug faculties were indebted to the account of active powers proposed by Galen and Avicenna.[21] According to these authors, drugs changed the constitution of the body by acting on its complexion, its matter, and its substance.[22] If Fernel adopted this reasoning, he also emphasized its linkage with Aristotelian hylomorphism. Indeed, the pharmacological scheme of *complexio*, matter, and substance was reformulated in terms of temperament, matter, and form. These notions shaped the order of three faculties in Renaissance pharmacology.

The first faculties came from the primary qualities of drugs, which resulted from the mixture of their elements, and acted on the body's temperament.[23] These qualities had four degrees of intensity: obscure, manifest, strong, and extreme. In addition, the second faculties came from the matter of drugs and

19 Fernel, *Therapeutices*, 4, 408–440.

20 Martelli, Petit and Raggetti, "Introduction," 6–15.

21 Avicenna, *Canon*, 1.2.2.1.15, vol. 1, 111b: "Quod comeditur et bibitur, in corpore humano tribus operatur modis. Aut enim in ipso sola sui qualitate operationem efficit. Aut sui materia. Aut operationem facit tota sui substantia."

22 Fernel, *Therapeutices*, 4.1, 409: "Tradendum quot quibusque modis immutetur corporis nostri naturalis constitutio. […] ex bona corporis et humorum temperie, ex materiae commoderatione, et ex formae seu substantiae integritate: nam et his tribus continetur humanum corpus, temperamento, materia atque forma."

23 Ibid., 4.2, 410–411.

affected the body by transforming its texture and density. For instance, the thin or thick "matter" of drugs could exert a thickening, liquefying, tightening or loosening action on the body. On top of that, the third faculties of drugs came from their substantial form. They affected the body by acting on the innate heat and by exerting a purgative or poisoning effect on specific humors and organs.

While the framework of drug faculties seemed highly theoretical, it was fundamental for the Galenic approach to therapy as a cure by contraries. This consisted in prescribing a remedy that had an opposite constitution – in quality or in substance – to that of the affected body part. The latter was restored to a healthy state by a drug whose temperament was qualitatively opposite, yet with the same degree of intensity. In this therapeutical framework, the second faculties, for their ability to act on the texture of the body parts, also played a prominent role. They were often included in an extensive list expounding their relationship with the qualitative degree of drugs and their physical effects; for instance, their ability of contracting or dilating the vessels, rarefying or condensing the body parts. As for the third faculties, they also involved the scheme of curing by contraries, although it was their substance that was contrary to that of the poison or the noxious humor.

Furthermore, drugs released their active powers during their assimilation by the organism. Before their ingestion, these powers were only "in potentiality", that is, latent within drugs, awaiting their activation by the heat of the digestive system.[24] In the process, drugs were also decomposed into their constituent elements. This reasoning stimulated late-Renaissance physicians to discuss the relationship between the elemental structure and the faculties of drugs, in which the senses played a central role.

2.2 *Texture and Taste*

The Galenic tradition long emphasized the connection between the sensory features and the minute structure of drugs. The main source on this theme was Galen's *On Simple Drugs*, which extensively described drug powers according to their qualities as well as the density and texture of their smallest parts. As Armelle Debru has shown, Galen's conception of "thin part" (*leptomere*) and "thick part" (*pachymere*) highlighted the natural divisibility of medicinal

24 Ibid., 4.1, 408–409: "Calor enim noster medicamentum dum subigit, eius naturam, temperamentum et alias quascunque vires detegit et explicat: hoc vero quasi proritatum communi rerum omnium conditione reluctatur et obsistit, atque vicissim contagione corpus afficiens, omnes in id vires suas expromit."

ingredients and the ensuing ability to penetrate the tissues of the organism.[25] Overall, such thin and thick parts pointed to the texture of drugs. Indeed, the various thicknesses and thinnesses of drug parts corresponded to their texture and density as solid, liquid, or aerial bodies.

Whereas these parts reflected the elemental structure of drugs, they did not entail any corpuscular theory of matter in Galen's *On Simple Drugs*. Galen was indeed famous for rejecting, throughout his works, the atomistic and corpuscular views of Greek physicians, mostly Asclepiades and Erasistratus. In fact, Galen's reasoning was centered on the porosity of the organism as well as the ability of simple drugs to take effect or to mingle into efficacious compounds if reduced to their smallest parts.[26]

Nonetheless, Renaissance physicians developed the Galenic conception of drug texture and density by reporting the flow of "minimal parts" (*partes minimae*) and "particles" (*particulae*). Their explanations emphasized the material structure of drugs into discontinuous entities that could unite or separate, hence forming smaller parts of diverse size, as well as bodies of various texture and density. Such a view underpinned Fernel's exposition of drug powers according to their ability to flow as thin, mediocre or thick humors with diversely tempered parts and "portions" (*portiones*).[27] Because of their minute structure, drugs could transform the body by condensing or coagulating the humors and, conversely, by emolliating, penetrating or even "cutting" and dividing them.[28] Such powers corresponded to the second faculties of drugs, which were related to their matter.

Strikingly, the Galenic tradition sought to determine drug faculties and texture through a particular sense: taste.[29] As Fernel explained, taste indicated

25 Armelle Debru, "Philosophie et pharmacologie: la dynamique des substances leptomères chez Galien," in *Galen on Pharmacology: Philosophy, History, and Medicine*, ed. Debru (Leiden, 1997), 85–102.

26 See Debru, "Philosophie et pharmacologie"; Véronique Boudon-Millot, "Place et enjeux du traité *Sur les éléments selon Hippocrate* dans l'œuvre de Galien," *Aitia*, 7 (2017), <https://doi.org/10.4000/aitia.1807>; David Leith, "Pores and Void in Asclepiades' Physical Theory," *Phronesis*, 57 (2012), 164–191.

27 See, for instance, Fernel, *Therapeutices*, 4.3, 412: "Aquae enim materiae [...] partes quasdam terrenas permistas calor externus tandem praeassans et urens atque siccans, salsum saporem inducit"; and ibid., 4.7, 421: "Ut quum intemperies affligit numeris duobus a mediocritate distans, si nullum in promptu medicamentum sit frigidum ordine secundo, duorum quae primi et tertii sint ordinis pares portiones temperatae, compositum efficient ordinis secundi."

28 Ibid., 4.2, 410–411.

29 See John Wilkins, "Bodily Fluids ('Humours') and Flavours in Galen's *Simple Medicines*," *Archives Internationales d'Histoire des Sciences*, 70 (2020), 54–75.

the first and second faculties of drugs, which corresponded, respectively, to their temperament and matter.[30] This statement reflected the longstanding accent on taste for drug testing in the medical tradition. If Galen dedicated the fourth book of *On Simple Drugs* to taste, this theme remained nevertheless diluted within his massive treatise of eleven books. In the Middle Ages, it was the Arabic pharmacological texts of Rhazes and pseudo-Mesue, among others, that put taste at the forefront of the exposition of drug properties. In addition, Avicenna's *Canon* posited taste as a sure and rapid means to infer the primary qualities of drugs and their material structure, into thin, mediocre, or thick parts.[31] Fernel, in turn, tacitly adopted Avicenna's types of flavors – acrid, acidic, fatty, salty, austere, sweet, bitter, and acerbic, in addition to insipid – each with a corresponding temperament and texture.[32]

Following this reasoning, Fernel assimilated the conception of flavors as a rational way to deduce the material texture of drugs (thick or thin) as well as their active qualities (hot or cold). In his *Therapeutices*, the systematic correspondence between flavors, matter and qualities followed the model provided by Avicenna's *Canon*, as visualized in the Table 1 below.[33]

By revealing the temperament and the material structure of drugs, taste enabled the determination of their active powers.[34] As Fernel observed, fatty drugs had a moderate temperament and thin matter, which displayed the faculty of loosening, softening, and emolliating the body. Bitter drugs had a hot and dry temperament with a thick matter, which pointed to the faculty of cleansing wounds and ulcers. Acerbic drugs had a cold and dry temperament with a thick matter, which indicated astringent and desiccant properties along with cicatrizing virtues. Insipid drugs had a slightly moist constitution and a thick matter, which had the "emplastic" faculty of filling and softening bodies.

30 Fernel, *Therapeutices*, 4.3, 411: "Ut autem facultates secundae, ita et medicamentorum sapores ex eorum materia primis qualitatibus instructa prodeunt: quumque horum magna sit ex origine affinitas, optima ratione sapores indices erunt et internuncii primarum atque secundarum facultatum."

31 Michael McVaugh, "Determining a Drug's Properties: Medieval Experimental Protocols," *Bulletin of the History of Medicine*, 91 (2017), 183–209; see also Frederick W. Gibbs, *Poison, Medicine, and Disease in Late Medieval and Early Modern Europe* (London, 2019), 1–38.

32 Fernel, *Therapeutices*, 4.3, 412; Avicenna, *Canon*, 2.1.3, vol. 1, 249a: "Sapores autem sunt octo, quos ipsi dicunt, qui sunt vere sapores, post insipidum. Et sunt dulcedo, amaritudo, acuitas, et salsedo, acetositas, ponticitas, stypticitas, et unctuositas."

33 Fernel slightly differed from Avicenna by defining sweetness, instead of insipidity, as the indicator of a qualitatively temperate and materially "mediocre" body.

34 Fernel, *Therapeutices*, 4.3, 411–414.

TABLE 1 Fernel's terminology of flavors with its Latin translation, along with alternative terms (with an asterisk) in the Latin translation of the *Canon* by Gerard of Cremona[a]

	Cold	**Equal**	**Hot**
Thin	Acidic (*acidus*, *acetus**)	Fatty (*pinguis*, *unctuosus**)	Acrid (*acer*, *acutus**)
Mediocre	Austere (*austerus*, *stypticus**)	Sweet (*dulcis*)	Salty (*salsus*)
Thick	Acerbic (*acerbus*, *ponticus**)	Insipid (*insipidus*)	Bitter (*amarus*)

a See also Charles Burnett, "*Sapores sunt octo*: The Medieval Latin Terminology for the Eight Flavours," *Micrologus*, 10 (2002), 99–112.

Besides, flavors could be combined within the same ingredient, hence indicating corresponding medicinal powers.[35]

Although taste was part of the rational method of testing drugs in Galenic medicine, it could show some limitations in determining their powers. In this regard, Fernel recalled that if taste did not supply enough information on simple drugs, physicians needed to resort to their own experience, through repetitive trials and observation.[36] As Michael McVaugh has pointed out, such an experimental way had been described by late-medieval physicians as a more fruitful method, although it took more time and required definite conditions.[37] In the context of Fernel's *Therapeutices*, the appeal for experience was particularly relevant for assaying the third faculties – namely, the powers associated to the substantial form of drugs. In Galenic medicine, this type of faculty was related to the "total substance" (*tota substantia*) of drugs.[38] As strong powers that were typical of purgatives and antidotes, they did not result from the mixture of elemental qualities but from the substance of bodies.

Most remarkably, the powers associated to the total substance escaped any method of testing through sensory properties. Hence their effects could only

35 Ibid., 414: "Quibus vero sapores varii inesse deprehendentur [...] diversae quoque substantiae atque facultates, ut detergendi et adstringendi seu corroborandi insunt."

36 Ibid.: "In quibus igitur sapor non certo poterit medicamenti vim atque facultatem exprimere, experientia succurrit ac supplet: atque etiam si gustu aut ratione videberis facultatem assequutus, eam tamen experimento identidem confirma."

37 McVaugh, "Determining a Drug's Properties," 183–209.

38 See Linda Deer Richardson, "The Generation of Disease: Occult Causes and Diseases of the Total Substance," in *The Medical Renaissance of the Sixteenth Century*, ed. Roger K. French, Iain M. Lonie and Andrew Wear (1985), 175–194; Gibbs, *Poison, Medicine, and Disease*, 195–204; De Vos, *Compound Remedies*, 71–78.

be identified with hindsight, through repeated observation and experience.[39] However, Fernel offered an original interpretation in associating these powers to certain types of preparation and sensory properties. This subject deserves further examination, as the notion of total substance was a central topic in Fernel's medical philosophy and was the most original aspect of his Platonic thinking.

2.3 *Odor, Color and the Total Substance*

Fernel ascribed the remarkable powers of the total substance to the third faculty of drugs. As he claimed, this type of power came from the substantial form of drugs, which was distinct from the four elements and had a celestial origin. In Renaissance pharmacology, such a view was ascribed to some key figures of Arabic-Latin medicine: above all, to Avicenna and pseudo-Mesue. Accordingly, the matter of living beings was achieved by the introduction of their substantial form coming from a celestial instantiation. If Avicenna conceived this celestial entity as a "giver of forms" (*dator formarum*) in the context of an emanationist cosmology, he also mentioned the celestial origin of the form in his medical writings, as testified his *De viribus cordis* ("On the Forces of the Heart"), a treatise appended to the edition of the *Canon*.[40] In his turn, Fernel put forth the heavenly nature of the form in a Renaissance-Platonic framework that was indebted to the philosophy of Marsilio Ficino (1433–1499).[41]

For their celestial origin and remarkable effects, the powers related to the total substance were considered as hidden or "occult" in Fernel's pharmacology.[42] Rather than operating through the qualities of the elements, they worked by similitude of substance in sympathy or antipathy with other substances. Either they opposed the targeted substance through "antipathy" or

39 Fernel, *Therapeutices*, 4.3, 412: "At vero tertias medicamentorum facultates, ut purgandi peculiarem humorem, aut obtundendi venenum, aut aliam quampiam ex iis quas mox subiiciam, non sapor ullave sensum qualitas, sed una patefacit experientia et observandi consuetudo."

40 Nicolas Weill-Parot, "Astrology, Astral Influences, and Occult Properties in the Thirteenth and Fourteenth Centuries," *Traditio*, 65 (2010), 201–230; Michael McVaugh, "The 'Experience-Based Medicine' of the Thirteenth Century," *Early Science and Medicine*, 14 (2009), 105–130; De Vos, *Compound Remedies*, 78–85.

41 Brian P. Copenhaver, "Scholastic Philosophy and Renaissance Magic in the *De vita* of Marsilio Ficino," *Renaissance Quarterly*, 37 (1984), 523–554; Hirai, *Medical Humanism*, 46–79; Liana Saif, "The Arabic Theory of Astral Influences in Early Modern Medicine," *Renaissance Studies*, 25 (2011), 609–626.

42 Fernel, *Therapeutices*, 4.5, 416: "Tertia medicamentorum facultas de qua mihi dicent dum restat, non e temperamento, non e materia, sed e tota rei substantia atque forma primum ac per se proficiscitur: ac proinde occulta totius substantiae proprietas appellari solet."

they assisted the affected body part through "sympathy." According to the medical tradition, this phenomenon mostly worked by attraction. In this regard, Fernel followed Hippocrates and Galen in comparing the attraction of humors by purgative drugs with that of iron by a magnet.[43] In his view, this phenomenon of attraction stemmed from the principle of similitude, or "like-by-like," between bodies having similar substances.

By acting through the substance of drugs, the third faculties had powerful effects for curing or poisoning the body. According to Fernel, these properties came from the innate heat, namely the life principle related to the total substance and the form of living beings. However, the innate heat disappeared after death, leaving the sole material body that was made of elements. In theory, this would entail that any remedy made of dead plants or animals would be devoid of third faculties. However, Fernel argued, vegetal and animal bodies were able to partially keep some hidden powers after death. These powers were implanted in their body and remained through their total substance, as was testified by the powers of cooked ingredients.[44]

Galenic pharmacology put forth diverse modes of preparation to activate and preserve the properties of drugs. Fernel took up this framework by expounding the extraction of medicinal powers through different ways of cooking. If infusion and "boiling" (*elixatio*) revealed the powers of drugs, it was, overall, distillation that allowed the extraction of their most powerful properties. As distillation was a common process for drug-making in the Renaissance, it is unsurprising that Fernel described its technical operations in a dedicated chapter of his *Therapeutices*.[45] Interestingly, he also offered a philosophical point of view on alchemy in his *De abditis rerum causis*.

Regardless of his critical standpoint on the transmutation of metals, Fernel emphasized distillation as a skillful "art" (*ars*) that allowed physicians to extract the total substance of drugs.[46] Such a process consisted of separating

43 Ibid., 3.4, 391: "Quanquam igitur attractio […] totius substantiae, similitudine fit, quae tamen a medicamentis purgantibus est, una similitudinis proprietate completur, qua […] lapis heraclius ferrum."

44 Fernel, *De abditis*, 2.18, 709: "Multorum nihilominus vires eousque penetraverunt, ut non solum in spiritu et in tenui substantia, verum etiam in crassiore materia et in tota substantia firmius inhaerescant, permaneantque abeunte totius forma, illiusque temperamento dissoluto. Nam quae ex herbis, aut ex aliis purgantibus medicamentis aqua vaporario elicitur, purgandi vim etiamnum retinet."

45 On distillation in the Renaissance, see William Eamon, "Alchemy in Popular Culture: Leonardo Fioravanti and the Search for the Philosopher's Stone," *Early Science and Medicine*, 5 (2000), 196–213.

46 Fernel, *Therapeutices*, 4.10, 425–426; idem, *De abditis*, 2.18, 710–721; see Sylvain Matton, "Fernel et les alchimistes," *Corpus: revue de philosophie*, 41 (2002), 135–175.

the liquid, oily and solid phases of plants and animals.[47] Although the three phases were elemental mixtures, they had a purer nature due the strong presence of their total substance and the weakness of their material properties. For Fernel, such remarkable powers stemmed from the substantial form of distillates, which alchemists had long called "quintessence" (*quinta essentia*).[48] If he discussed this theme in reference to the Platonic alchemy of Giovanni Aurelio Augurello (ca. 1456–1524), the notion of quintessence had deeper roots in medieval alchemy. Most notably, pseudo-Ramon Lull and the French physician John of Rupescissa emphasized the extraction of alchemical essences for medicinal purposes.[49]

According to Fernel, the extracted oil of plants revealed strong powers through characteristic odors, flavors, and colors.[50] This oil corresponded to the primitive humor of plants (*humor primigenium*).[51] Also called radical moisture (*humidum radicale*), it had been established in Arabic-Latin medicine and alchemy as a fatty humor with restorative powers, which was present in all living beings.[52] Fernel espoused this medieval framework in describing radical moisture as an oily wick that maintained the flame of innate heat. In a pharmacological context, the same moisture explained the strong powers of oils. Remarkably, physicians could assess its presence in distillates if the latter expressed strong odor and taste. The same went for distilled waters, which were medicinal only if they manifested characteristic odor and taste.[53] Moreover, Fernel argued, colors, too, indicated the strength of distilled oils. These were distinguished into two types. One was whitish (*albicans*) or pale (*pallidum*);

47 Fernel, *De abditis*, 2.18, 710; see also idem, *Therapeutices*, 4.10, 425.

48 Fernel, *De abditis*, 2.18, 714.

49 Michela Pereira, "Heavens on Earth: From the *Tabula Smaragdina* to the Alchemical Fifth Essence," *Early Science and Medicine*, 5 (2000), 131–144; Hiro Hirai, *Le concept de semence dans les théories de la matière à la Renaissance, de Marsile Ficin à Pierre Gassendi* (Turnhout, 2005), 83–103.

50 Fernel, *De abditis*, 2.18, 712: "Efficaciorem in oleo […]: illud siquidem et odore, et sapore totius substantiam referens, propria sedes dignoscitur insiti spiritus et caloris, in quibus proprietas tota subsistit foveturque."

51 Fernel, *Therapeutices*, 425: "Stirpis cuiusque materiam humorem continere […] primigenium, in quo praecipua vis inest […]. Oleum vero humidi est primigenii portio aeria, atque ut illius odorem saporemque, ita et vires plurimum refert."

52 See Gianna Pomata, "Innate Heat, Radical Moisture and Generation," in *Reproduction*, ed. Nick Hopwood, Rebecca Flemming and Lauren Kassell (Cambridge, 2018), 195–208; Chiara Crisciani, "Aspetti del dibattito sull'umido radicale nella cultura del tardo medioevo (secoli XIII–XV)," *Arxiu de textos catalans antics*, 23–24 (2005), 333–380.

53 Fernel, *Therapeutices*, 4.9, 425: "Aqua stillaticia alimentarii humoris portio est tenuior: quae si sine odore et sine sapore est, nullas, sin odorem saporemque stirpis retinet, exiguas illius vires habet."

the other, yellowish (*flavescens*) or reddish (*rubens*), was the more powerful of the two.[54]

Fernel's description of medicinal oils and waters is original in many respects. Not only were these alchemical products of distillation drugs with third faculties; they also had the exceptional status of "occult" remedies that could be known through the senses, whereas these kinds of remedy traditionally escaped the assessment of third faculties. Besides, Fernel's argument offers a striking contrast with the traditionally minor role that odors and colors played in Galenic pharmacology.[55] Galen, indeed, briefly addressed odors and colors in the end of the fourth book of *On Simple Drugs*, only to say that he did not consider them reliable for evaluating the temperament of drugs.[56] In medieval medicine, Arabic-Latin authorities took up this view by presenting odors and colors as less dependable than flavors for the identification of drug properties.[57] This explains why, outside of his views on distilled oils and waters, Fernel only briefly mentioned the role of odors and colors, mostly for their ability to facilitate the ingestion of compound drugs.[58] As will be seen in the case of Cesalpino, Renaissance interpretations of Aristotle offered alternative views on the role played by these senses in a medical context.

3 Sensing Tangible Bodies: Cesalpino on Drug Faculties

In the history of science, the physician and naturalist Andrea Cesalpino is mostly known for his innovative account of botany. His treatise *De plantis* (1583) was particularly original for proposing a classification of plants according to their

54 Fernel, *Therapeutices*, 4.10, 426: "Deinde [...] est [...] paulatim calfacienda, dum in aliud agglutinatum vas profluat oleum primum pallidum dein flavescens."; idem, *De abditis*, 2.18, 710: "Id [oleum] autem duplex: unum tenue et albicans, alterum siccius atque rubens." and 712: "Efficaciorem in oleo, multoque in rubente quam in albo: illud siquidem et odore, et sapore totius substantiam referens."

55 On smell and colors in Galenic medicine, see Katelynn Robinson, *The Sense of Smell in the Middle Ages: A Source of Certainty* (London – New York, 2019); Véronique Boudon, "La théorie galénique de la vision: couleurs du corps et couleurs des humeurs," in *Couleurs et vision dans l'Antiquité classique*, ed. Laurence Villard (Rouen, 2002), 65–76.

56 Galen, *De simplicium*, 4.22–23, vol. XII, 696–703; see also Avicenna, *Canon*, 2.1.3, vol. 1, 248b: "Sapores ergo in significatione sunt plus veri, deinde odores, post colores."

57 See Iolanda Ventura, "On the Impact of Arabic Pharmacological Knowledge in Europe: The Example of Ps.-Serapion's *Liber Aggregatus de Simplicibus Medicinis*," *Micrologus*, 28 (2020), 233–234 et passim.

58 Fernel, *Therapeutices*, 4.7, 422: "Comparatur autem medicamento iucunditas colore, odore, sapore. [...] Haec enim odoris iucunditate non modo oblectant, sed et corroborant, et corporis spiritus vehementer reficiunt, animumque exhilarant."

morphology and reproductive organs instead of their medicinal powers.[59] Cesalpino anchored this view in the Aristotelian conception of plant generation through the vegetative soul. Outside of this botanical framework, Cesalpino's medical philosophy has drawn less attention from historians. Yet, he produced a series of works on Galenic medicine, including a treatise on the faculties of drugs, *De medicamentorum facultatibus* (1593).[60] Published between his *De plantis* and his mineralogical work *De metallicis* (1596), this treatise encapsulated Cesalpino's interest in the active powers of vegetal, mineral, and metallic bodies from the perspective of Galenic medicine and Aristotelian physics. Rather than classifying these ingredients in the fashion of Dioscorides' *Materia medica*, Cesalpino explored the ways of determining their faculties according to Galen's *On Simple Drugs*.[61]

Before Cesalpino, botanist physicians such as the German Leonhart Fuchs (1501–1566) and the Italian Pierandrea Mattioli (1501–1578) published on the faculties of drugs in addition to their works on plants. In comparison with them, Cesalpino's *De medicamentorum facultatibus* was remarkable for its extensive discussion on a specific theme: the taste, odor, and color of simple drugs. In medieval and Renaissance pharmacology, taste was concisely treated through an enumeration of flavors with their corresponding temperament and texture. As for odors and colors, they received an even briefer account in Galenic pharmacological texts. In contrast, Cesalpino's detailed exposition of the senses offered a valuable appraisal of the philosophical tradition on the physical properties of bodies. In order to understand these views, I shall first examine Cesalpino's conception of drug faculties and its debt to Averroes's pharmacology.

3.1 *Mixture and Material Affinity*

As a Galenic physician, Cesalpino envisaged drug powers according to an ordinal number of faculties. If he adopted the broad framework of temperament, matter, and substance to explain these faculties, it was in a different way from that of Fernel.[62] The latter, along the lines of Avicenna, proposed three types

59 Jensen, "Description, Division, Definition," 185–206; Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago, IL, 2006), 215–229.

60 Andrea Cesalpino, *De medicamentorum facultatibus libri duo*, in *Quaestionum peripateticorum libri v* (Venice, 1593), 242r–291v; see also idem, *Quaestionum medicarum libri duo*, in *Quaestionum peripateticorum libri v* (Venice, 1593), 170r–241v.

61 Cesalpino, *De medicamentorum*, 1.1, 242r: "Videamus igitur rationem, qua singulae medicamentorum vires innotescunt, diffuse quidem a Galeno pertractam in libris de simplicium medicamentorum facultatibus, in compendium autem nunc a me redactam."

62 We can only assume Cesalpino's awareness of Fernel's medical works, given his reluctance to quote contemporary authors in his treatises.

of drug faculties, whereas Cesalpino stated four types.[63] The first and second faculties kept the traditional classification as they were related, respectively, to their temperament (primary qualities) and their material properties (secondary qualities). By contrast, the third faculties were defined as particular powers, such as the ability of digesting, cleansing and repelling substances. As for the fourth faculties, they aimed at specific organs and humors, for instance, by fortifying the heart and the brain, or by producing milk and seed.[64]

Before going further into Cesalpino's interpretation, it is important to recall that the quadripartite order of drug faculties had been previously established by Averroes in his *Colliget*.[65] Following an Aristotelian interpretation of Galen, Averroes deviated from Avicenna's account of tripartite powers by stating four types of "virtues" (*virtutes*) and related "operations" (*operationes*). While the first and second virtues were related to temperament and matter, the third virtues were associated with "particular body parts" (*propria membra*), and the fourth virtues with peculiar "properties" (*proprietates*) due to their total substance.[66] Interestingly, the framework of four faculties had often been adopted by Galenic physicians in the sixteenth century, though not necessarily by fully endorsing Averroes's explanation.[67]

At any rate, Averroes's account of drug powers gives important insights into the conception of third and fourth faculties. In the *Colliget*, the third virtues were manifest powers that originated from elemental qualities and applied to specific body parts, for instance, the ability to fortify the chest, to provoke menstruation, and to affect the production of sperm or milk.[68] It was to the fourth virtues that Averroes attributed the medicinal properties traditionally ascribed

63 Cesalpino, *De medicamentorum*, 1.1, 242v–243r; see also idem, *Quaestionum*, 1.4, 176rv.

64 Cesalpino, *De medicamentorum*, 1.1, 242rv: "Cum autem facultates […] consistant […] vel in tertiis, ut glutinandi, concoquendi, abstergendi, repellendi: et tandem quae opera magis particularia et partes peculiares respiciunt: quae inter quartas facultates recenseri possunt, ut gignendi lac, et semen: ex obstruendi, hepar, lienem: aut roborandi cor, cerebrum, ventriculum."

65 Averroes, *Colliget*, 5.1, 86vb: "Medicinae […] habent multas operationes, quas medici appellant virtutes primas, secundas, et tertias, et proprietates." and 5.24, 93vb: "Sed dicamus quod operationes medicinarum secundum quod dictum est, sunt quatuor, primae et secundae, et tertiae, et propriae."

66 Ibid., 5.3, 87r–88v and 5.20, 91v–93r.

67 On the Renaissance reception of Averroes's *Colliget*, see Hasse, *Success and Suppression*, 115–121.

68 Averroes, *Colliget*, 5.20, 91va: "Et dicamus quod istarum medicinarum quaedam sunt quae frangunt lapidem, et quaedam quae provocant menstrua, et quaedam quae generant lac, et quaedam quae generant sperma, et quaedam quae diminuunt lac et sperma, et quaedam mundificant pectus."

to the total substance, such as purgation and the counteraction of poison.[69] As peculiar properties, the fourth virtues worked by attracting similar substances through their "specific form" (*forma specifica*). Strikingly, for Averroes, these powers stemmed from the particular proportion of the elements and its resulting convenience with that of other bodies.[70] In consequence, the remarkable properties of the total substance did not stem from some "occult" celestial influence but from the "manifest" mixture of the elements.

The question whether the properties of the total substance were occult or manifest raised many debates in Galenic pharmacology. As Saskia Klerk has pointed out, late-Renaissance physicians neither reached a consensus concerning their nature, nor agreed on their status as third or fourth faculties.[71] As we have previously seen, Fernel proposed a Platonic account of the total substance, which was related to the third faculties of drugs. Rooted in Avicenna and pseudo-Mesue, his interpretation associated these properties to a celestial influx that applied to the specific form of drugs. However, late-Renaissance physicians might have followed a different direction by endorsing Averroes's interpretation of four faculties. In this regard, the Italian physician Girolamo Mercuriale (1530–1606) acknowledged the action of the total substance through the specific form of drugs, while highlighting its elemental nature coming from the proportion of mixture.[72] Cesalpino also chose this interpretative path, yet in a more intransigent way.

In adopting an Averroistic framework of drug faculties, Cesalpino stood with the detractors of the 'occult' properties related to the total substance. In his view, such properties mirrored the inability of physicians to identify the complex temperament resulting from the second and third faculties of drugs.[73]

69 Ibid., 5.21, 92vab: "Istud est esse proprietatis, et totius substantiae. […] Et qui quaerunt in qua specie harum operationum operentur medicinae laxativae: eis respondendum est, quia habent hanc operationem per modum attractionis, inquantum est attractio, et per proprietatem."

70 Ibid., 5.21, 92va: "Sed alium modum medicinarum operationis appropriare non possumus primis virtutibus elementorum substantialiter: v.g. attractio, quam facit magnes in ferro […]. Et hoc accidit propter proportionem, et convenientiam, quae est inter ipsum et ferrum. Et […] non est nisi in mensuris mixtionis elementorum in eis, hoc est in trahente et attracto."

71 Klerk, "Trouble with Opium," 287–316.

72 On Mercuriale's pharmacology, see Andreas Blank, "Sixteenth-Century Pharmacology and the Controversy between Reductionism and Emergentism," *Perspectives on Science*, 26 (2018), 157–184.

73 Cesalpino, *De medicamentorum*, 1.1, 242v: "Sed hi cum per hoc principium nequeant distinguere inter ea quae in secundis et tertiis et caeteris facultatibus maxime distant, quae saepe eiusdem temperamenti sunt coguntur confugere ad quasdam proprietates occultas, quae a tota substantia provenire dicuntur."

Most remarkably, Cesalpino buttressed this claim on Aristotelian grounds. Following Aristotle's *Meteorology*, he considered simple drugs as vegetal and animal bodies, whose properties came from the mixture of their elements.[74] Since they were no longer alive, their powers could not stem from a celestial agent or from the soul.[75]

As Cesalpino emphasized the elemental nature of simple drugs, he recalled that Galen, too, attributed their powers to the mixture of elements, especially in his treatises *On the Elements According to Hippocrates* and *On Mixtures*. Thus, for Cesalpino, Galen's account of the total substance in *On Simple Drugs* did not aim to advance 'occult' powers that were alternative to elemental qualities. In fact, the notion of total substance aimed to highlight the role of attraction, similitude, and experience in understanding drug powers. Indeed, if purgatives and antidotes attracted humors and poisons, it was because the latter were familiar to them.[76] For the medical tradition, this attractive power, and the resulting effect of 'sympathy,' worked through the similitude of substance. But for Cesalpino, attraction was due to the material "propensity" (*propensio*) of bodies under the action of heat.[77] Strikingly, this led him to reformulate the similitude of substance in terms of material "affinity" (*affinitas*). The attractive power that drugs exerted on substances stemmed from their common material "conditions" (*conditiones*), such as weight and density.[78] Coming from the elemental parts of bodies, these material conditions caused the powers of their total substance.

Such an accent on the material nature of bodies shaped Cesalpino's understanding of the senses. For him, all animal, vegetal, and mineral simples were natural bodies made of the four elements, which caused their temperament

74 Aristotle, *Meteorology*, 4.1, 378b26–34.

75 Cesalpino, *Quaestionum*, 1.13, 199r: "Virtutes […] organicarum partium, cum ab altero principio ortum ducant, scilicet ab anima: […] merito diviniores dicendae sunt, et transcendere primarum qualitatum vires. At in medicamentis non has quaerimus, non enim agunt ut organica, aut animata. Ergo praeter mixtionem non relinquitur in ipsis alia virtus."

76 On Cesalpino's account of the total substance, see Gibbs, *Poison, Medicine, and Disease*, 208–209.

77 Cesalpino, *Quaestionum*, 1.13, 200v: "Actio autem attractionis non a similitudine fit, sed a caliditate quadam adiuvante tamen propensione materiae, quae in similitudine consistit."

78 Ibid.: "Accidunt autem haec omnia […] propter quasdam conditiones materiae, ut levitatem gravitatem, crassitiem tenuitatem, aliaque huismodi […]. Hinc purgantia medicamenta diversa diversos humores trahunt: scilicet ob affinitatem quandam materiae, qua facile uniuntur, ut magnes cum ferro."

and medicinal powers.[79] However, physicians could not access these elements, but only sensible bodies made of them, mostly humors.[80] Thus, it was the materiality of humors that revealed the elemental composition of drugs, by means of sense and sensation. Such a reasoning grounded Cesalpino's focus on the sensory properties of drugs, starting with taste as the sense par excellence for detecting the constituents of bodies.

3.2 *Taste as a Contact Sense*

Cesalpino followed the Galenic pharmacology in establishing taste as the most appropriate way to distinguish drug faculties with certainty. As argued in the previous section, this claim was rooted in Galenic medicine, especially the medieval conception of taste as the safest means to infer the temperament and density of drugs.[81] However, for Cesalpino, this reasoning applied even for the case of powers related to the total substance.[82] Thus, in the same way as Fernel, Cesalpino expressed the possibility of assaying such 'occult' properties through the senses, but on different grounds.

Beyond the traditional emphasis on drug testing through taste, Cesalpino's account was remarkable in claiming the primacy of flavors as tangible qualities. Far from contrasting touch and taste as two completely distinct senses, learned physicians endorsed the Aristotelian conception of taste as a contact sense.[83] Cesalpino applied this approach to the medical field by referring to Aristotle's *On the Senses* and *On the Soul*.[84] Centered on sensory functions and sensations as physiological operations of body and soul, these treatises were

79 Ibid., 1.1, 170r: "Nullum est corpus tangibile, quod medicinae scientiam effugiat. Nam saltem materia medica […] in omni corpore tangibili reperitur: omne enim vim habet agendi in corpus humanum saltem primis qualitatibus, quae tangibiles sunt: seu in genere plantarum, seu animalium, seu sint corpora inanimata, ut metallica, et elementa."

80 Ibid., 171r: "Cum enim ad uniuscuiusque sanitatem conservandam, et restituendam non sufficiat universalis philosophi contemplatio, sed oporteat minimas quascunque differentias sensibiles tenere. Ideo medicus corpus humanum non in quatuor elementa resolvit, sed in quatuor humores."

81 Ibid., 1.13, 199r: "[Galenus] extollit organum gustus, utpote quod percipit species iuxta totarum substantiarum tum proprietatem tum alienitatem."

82 Ibid., 1.1, 243r: "Soli autem sapores certius and propinquius non solum temperamentum ostendunt in calido frigido humido et sicco: sed et reliquas facultates longe efficaciores tum ad morbos gignendos, tum sanandos."

83 Ronald Polansky, *Aristotle's* De Anima: *A Critical Commentary* (Cambridge, 2007), 313–320.

84 Aristotle, *De anima*, 2.10; Aristotle, *De sensu*, 4. On Cesalpino's reception of Aristotle's *On the Senses*, see Roberto Lo Presti, "Entre aristotélisme médical et médecine aristotélisante: le rapport entre médecine et philosophie dans les commentaires italiens du XVI^e siècle au *De sensu* d'Aristote," in *Médecins et philosophes: une histoire*, ed. Claire Crignon and David Lefebvre (Paris, 2019), 197–223.

particularly relevant for the integration of Aristotelian scholarship within the medical curriculum in the Renaissance.[85] According to these sources, Cesalpino put forward taste as a particular type of touch whose instrument, the tongue, was the most dependable guide to find drug powers.[86] Other sensory properties, such as odor and color, also played a role in the discussion, but were deemed less relevant for the identification of temperament because of their less tangible character.[87]

The primacy of taste in the knowledge of bodies required further philosophical justification since flavors were traditionally considered as secondary qualities. As Cesalpino claimed, their prevalence for assessing drug powers had been established by Hippocrates in *On Ancient Medicine* about the contrasting flavors and properties of raw and cooked food.[88] Just as Hippocrates noted that flavors had greater healing powers than the primary qualities, Galen, too, in the fourth book of *On Simple Drugs*, emphasized the importance of taste.[89] During their ingestion, and their concomitant transformation into humors, food and drugs revealed their healing powers through taste.[90] Cesalpino deemed this crucial because the medicinal "mixture" (*krasis*) of bodies – namely, their temperament – remained in potentiality within drugs. It was taste that allowed physicians to figure out the properties of drugs through reason, namely through a rational and systematic method.[91] The faculties of drugs

85 Börje Bydén, "Introduction: The Study and Reception of Aristotle's *Parva naturalia*," in *The* Parva naturalia *in Greek, Arabic and Latin Aristotelianism: Supplementing the Science of the Soul*, ed. Börje Bydén and Filip Radovic (Cham, 2018), 1–50.

86 Cesalpino, *De medicamentorum*, 1.4, 245r: "Hinc fit ut a saporibus certissima habeantur facultatum indicia, non solum primarum sed and reliquarum omnium. Cum enim gustus sit tactus quidam, etiam sapor tangibile quoddam erit, sed magis particulare."

87 Ibid., 245v: "Hinc factum est, ut homo, qui prae caeteris animalibus gustum habet exquisitissimum sicut et tactum, nullo alio instrumento exactius quam lingua medicamentorum facultates perdiscere possit."

88 Hippocrates, *On Ancient* Medicine (= *VM*), 14; Cesalpino, *Quaestionum*, 1.4, 174r: "Secundae tamen qualitates, seu conditiones sint primarum, seu illis adiunctae, aut insequentes, vires possident longe maioris momenti, quam primae."

89 Cesalpino, *Quaestionum*, 1.4, 174v: "Concludit, in caliditate, frigiditate, humiditate, et siccitate non magnam vim inesse ad morbos gignendos, sed longe potentiores esse facultates ad alterandum corpus humanum in saporibus, quas inter qualitates sanandas reponimus."

90 Ibid., 245r: "Quemadmodum autem ex varia primarum qualitatum mixtione varia oriuntur temperamenta, sic et varii sapores consurgunt. […] non solum secundum intensionem et remissionem primarum qualitatum, sed etiam pro diversitate terrei sapidi et humoris in quo diluitur."

91 Ibid.: "Si igitur primae qualitates actu essent in medicamentis, non egeremus ratiocinio ad eas investigandas, sensu enim tactus statim innotescerent. Sed quoniam in unoquoque temperamento latent potentia existentes, ob id cogimur ratione invenire."

came from their temperament and their material conditions, especially their density or rarity, heaviness or lightness, roughness or smoothness.[92]

In presenting flavors and their corresponding powers, Cesalpino was aware of their variable number and terminology in the medical tradition. These variations of taste corresponded to the qualitative and material configuration proper to each body. Drug temperament consisted in various degrees of primary qualities according to the scholastic conception of "latitude" (*latitudo*), namely a gradual scale of complexion that held for each body.[93] Nonetheless, Cesalpino noted, the broad range of flavors was framed in a more restricted catalog. If Aristotle and Galen posited a canonical list of seven flavors – sweet, bitter, salty, acrid, acidic, austere and acerbic –, they also mentioned fattiness and insipidness, which were taken up by Arabic-Latin authorities, such as Avicenna and Averroes.[94] As has been shown, Renaissance physicians like Fernel adopted this framework in their pharmacological account.

Cesalpino, in turn, distinguished seven traditional flavors and mentioned additional ones throughout *De medicamentorum facultatibus*. These included insipid, fatty, "astringent" (*astringens*) – which was in between austere and acerbic –, as well as "nitrous" (*nitrosus*), which was in between salty and bitter.[95] Nitrous bodies included alkaline salts such as "potash" (*lixivium*) and "saltpeter" (*niter*), which were used, respectively, as a detergent and a fertilizer. This type of body more broadly denoted Cesalpino's interest in minerals and metals, as well as oils, acids, salts, and combustible materials. Their ways of formation, from terrestrial exhalations to coagulation, followed the reasoning of Aristotle's *Meteorology*, which Cesalpino further explored in his 1596 *De metallicis*.

If Cesalpino was attentive to the flavors of minerals and metals, it was plants, above all, that exemplified his theory of taste. His main source, the fourth book of Galen's *On Simple Drugs*, often referred to Theophrastus to highlight two well-known phenomena related to taste in the vegetable realm: the ripening of fruits – from insipid, acidic, astringent, or sour to sweet – and wine production.

92 Ibid., 176r: "Cum sapores diversi ex varia corporum mixtione oriantur […] non solum secundum primas qualitates varia proportione acceptas sapores variantur, unde varia temperamenta consurgunt, sed etiam secundum alias conditiones miscibilium: […] si crassarum aut tenuium sint partium: si densa, vel rara: si gravia, an levia: si aspera, aut lubrica."

93 See Per Gunnar Ottosson, *Scholastic Medicine and Philosophy: A Study of Commentaries on Galen's Tegni, ca. 1300–1450* (Naples, 1984), 167 et passim; Ian Maclean, *Logic, Signs and Nature in the Renaissance* (Cambridge, 2002), 171–190.

94 Aristotle, *De sensu*, 4, 442a15–20; Galen, *De simplicium*, vol. XII, 619–621.

95 Cesalpino, *Quaestionum*, 1.4, 176r.

The gradual transformation of grape into verjuice, ripe grape, wine and its residual lees and flower, as well as its transformation into alcohol and vinegar, were the most obvious examples of how a same body may change in taste and texture. Such variations, in turn, reflected the corresponding inner change of the material structure and temperament of drugs. This line of argumentation raised the attention of Cesalpino, who carefully mentioned the sixth book of Theophrastus' *De causis plantarum* about the relationship between flavors, odors, and the constitution of plants.[96] Theophrastus' treatise was particularly appealing to Cesalpino as a physician and naturalist, in offering an Aristotelian account of botany that was focused on the empirical explanation through the senses.[97]

3.3 *Medicinal Odors and Chromatic Change*

In comparison with flavors, odors and colors traditionally played a subordinate role in assessing drug properties. Cesalpino recalled that such a stance was rooted in Aristotle's approach to olfaction and vision as sensory perceptions that reached the body through a medium.[98] Following this view, he first addressed the case of odors. Olfaction was a less tangible sense as it was mediated by the air before reaching the nose. Moreover, odors were less crucial for determining drug powers because they were not systematically present in bodies and because humankind was ascribed the least accurate sense of olfaction. For this reason, touch and its correlate, taste, remained the most certain senses in assessing medicinal properties.[99] Still, Cesalpino believed it important to tackle the theme of odors because they might offer healing effects regardless

96 See George Raynor Thompson, "Theophrastus on Plant Flavors and Odors: Studies on the Philosophical and Scientific Significance of *De Causis Plantarum* VI" (PhD diss., Princeton University, 1941).

97 See Roger K French, *Ancient Natural History: Histories of Nature* (London, 1994), 68–92; Lucie Strnadová, "The Role of Sensory Qualities in Renaissance Natural History: The Case of Mattioli's Herbal," *Early Science and Medicine*, 25 (2021), 543–561.

98 Aristotle, *De anima*, 2.9; Aristotle, *De sensu*, 5; see Cesalpino, *De medicamentorum*, 1.12, 256r: "Medio igitur modo [odor] se habet inter sensibilia, quae tangendo agunt, et ea quae per medium, ut sonos et colores."

99 Cesalpino, *De medicamentorum*, 1.12, 255v: "Quod enim in sensum tangendo facit sapor, illud idem per medium aerem in respirantibus […] odor veluti praenuncium quoddam erit facultatum, idque ambiguum ob incertitudinem: longe enim certior est tactus et gustus: ob id hoc genus odorum medicus non quaerit"; see Rebecca Steiner Goldner, "Aristotle and the Priority of Touch," in *Touch and the Ancient Senses*, ed. Alex C. Purves (London, 2018), 50–63.

of their flavor: for instance, as fragrances coming from flowers, unguents, and aromatic herbs.[100]

If odors at times had medicinal powers, this entailed, for Cesalpino, that they had a temperament, hence an elemental constitution. However, because of their status as "vapors" (*vapores*) or "spirits" (*spiritus*), odors were more challenging to define as bodies made of elements. For this reason, Cesalpino considered it necessary to establish their corporeal nature before addressing their various types and temperaments.[101] Following Aristotle's natural philosophy, he described odors as smoky exhalations, namely dry fumes resulting from the heating of fatty terrestrial bodies. This type of aerial body was typical of aromatic herbs and fatty substances, which were the most fragrant.[102] Their aerial nature caused their hot and dry constitution, yet with hot, cold, dry, or moist qualities that were present in potentiality. For instance, the odor of rose and vinegar had cold faculties. After their absorption, odors deployed their faculties so as to alter the temperament of the brain.

Odors were diversely classified in ancient medicine and natural philosophy. If Cesalpino kept Galen's broad correspondence between seven types of odor and the order of seven flavors, he mostly followed Aristotle's classification in *On the Senses* by distinguishing pleasant and unpleasant odors.[103] To this scheme, he added the categories of sharp, light, heavy, and medicinal odors according to Theophrastus' *On the Causes of Plants* and Dioscorides' *Materia medica*.[104] Within this framework, Cesalpino characterized odors by a certain balance in temperament and matter due to the proportion of their primary

100 Cesalpino, *De medicamentorum*, 1.12, 255v: "Sed quoniam est alterum genus odorum homini proprium [...] quod per se delectabile est [...] quia facit sanitatem, de hac in praesentia dicendum est vires enim habet per se non ratione saporis, ut sunt odores florum, unguentorum, et aromatum."

101 Ibid., 256r: "Corpus enim aliquod esse necesse est, non solam qualitatem: alterat enim corpus tangibile, cerebrum calefaciendo."

102 Ibid., 256r: "Patet igitur eorum odorum substantiam, qui corpus afficiunt, spirituosam esse. Quoniam autem spiritus aerea quaedam substantia est, atque haec vel humida et vaporosa ex aqua, vel sicca et fumosa ex terrestri materia, quae proprie exhalatio vocatur: odor in fumosa magis consistit quam vaporosa." See Aristotle, *Meteorology*, 1.4.

103 Isabelle Boehm, "Couleur et odeur chez Galien," in Villard, *Couleurs et vision dans l'Antiquité classique*, 77–96.

104 Cesalpino, *De medicamentorum*, 1.12, 257r: "Communi autem nomine appellare solemus hos quidem beneolentes, alios maleolentes, seu graveolentes [...] et inter maleolentes quosdam dicimus faetentes [...]. Praeterea et alio modo distingui solent, ut alii acuti dicantur, alii lenes, alii graves, alii medicati."

qualities as well as the conditions of their parts.[105] Because they had an aerial constitution and a material structure into thin parts, odors were familiar to the physiological spirit. Thus, they affected this spirit by similitude of substance so to restore or damage health. In this regard, medicinal odors fortified the temperament of vital organs, especially the brain and the heart, and counteracted the noxious vapors in the body, for instance flatulence and pestilence.[106] A common example of therapeutic odors was the fumigation made of plants or metals for the treatment of pestilential diseases.[107]

In contrast to flavors and odors, colors were the least sensory properties that could help to determine the properties of drugs with certainty. Indeed, each of them could be constituted by any of the primary qualities.[108] Once again, Cesalpino pointed out their lack of tangibility. Colors required a medium to reach the eyes through the reflection of light on the surface of an object.[109] For Cesalpino, it was the various levels of transparency that explained the infinite number of colors. These shades came from the various blending of extreme colors – white and black – as well as the level of transparency or opacity of the body.[110] For this explanation, Cesalpino drew upon ancient authors, mostly Galen, Aristotle, and Theophrastus.[111]

Following these ancient sources, Cesalpino expounded the distribution of colors between two extremes: white (*albus*) and black (*niger*). These comprised a series of intermediates: yellow (*flavus*), red (*puniceus*), green (*viridis*), blue (*cyaneus*) and dark (*fuscus*). This did not prevent Cesalpino from mentioning a series of shades for each color, in allusion to natural materials. For instance, milky (*lacteus*), saffron (*croceus*), purple (*purpureus*), grassy (*herbaceus*),

105 Ibid., 1.15, 259r: "Insuavium quoque non eadem est natura: multis enim modis discedere quid potest a commensurata illa proportione, in qua similitudo consistit cum natura hominis. Nam excessus erit aut in primis qualitatibus, aut in conditionibus materiae."

106 Ibid., 1.14, 258v: "[Odores suaves] forte ad roborandum cor, cerebrum, et reliqua membra principalia a medicis laudantur […] Odores igitur suaves ratione quidem temperamenti naturalem spiritus qualitatem conservant, ratione vero substantiae familiaris eundem nutriunt."

107 Ibid., 1.15, 260r; see Robinson, *Sense of Smell*.

108 See Galen, *De simplicium*, 4.23, vol. XII, 702–703; Cesalpino, *De medicamentorum*, 1.17, 260r: "Ex coloribus incertam esse temperamenti significationem, ex eo colligit Galenus […] quod in unoquoque colore et calida et frigida, et humida et sicca reperiuntur."

109 Boudon, "La théorie," 65–76; Tawrin Baker et al., "Introduction: Early Modern Color Worlds," *Early Science and Medicine*, 20 (2015), 289–307.

110 Cesalpino, *De medicamentorum*, 1.18, 261v: "Quasi colores alii simplices, qui ex luminis et opaci concursu solum creantur: alii compositi ex aliis coloribus, quos pictores imitari possunt."

111 Ibid., 261rv; Aristotle, *De sensu*, 3; Theophrastus, *De causis plantarum*, 6.4.

cerulean (*caeruleus*), ashen (*cinereus*), and sooty (*ater*) were so many shades that Cesalpino touched upon in reference to Galen's works, Dioscorides' pharmacy, and Actuarius' uroscopy.[112]

As Cesalpino underlined, the mixture of the extremes caused the pleasant or unpleasant nature of colors. Each color corresponded to the proportion of these extremes according to their respective degree of intensity in the same way as a musical harmony or the mixture of primary qualities.[113] In this regard, Cesalpino mentioned "emerald" green (*smaragdus*) as the most proportionate and pleasant color, with soothing effects on the eyes, following Aristotle's explanation of the rainbow and Pliny's description of gems.[114] Apart from this brief mention of the color green, Cesalpino did not attribute healing powers to colors. In fact, his medical viewpoint on this question was limited to the observation of color change that occurred to plants, minerals, and humors.

If colors could not inform physicians about the temperament of drugs, Cesalpino yet considered them profitable for medicine because they revealed the various stages of alteration to which a single body was subject. As he pointed out, Galen set up the requirement that each order of color should be examined according to each "kind" (*genus*) of body.[115] Following this reasoning, Cesalpino discussed how the chromatic change of mineral, vegetal or animal ingredients reflected their physical transformation, mostly under the action of heat, and their value for medicinal purposes.[116] The most obvious example of this type of variation was the successive colors of vegetables and fruits during their maturation, as well as the different colors of wine.[117] This general explanation aside, Cesalpino's account followed the pharmacological

112 Cesalpino, *De medicamentorum*, 1.18, 260v–263r.

113 Ibid., 1.18, 261rv: "Ob diversam vero proportionem medii colores hi quidem iucundi, hi vero minus censentur: quemadmodum in concentu […] accidit. Ubi enim proportio inordinata fuerit, sonus fit insuavis, ubi vero ordinata, et certis quibusdam numeris, suavissimus. Nos idem in calidi et frigidi mixtione notavimus."

114 See Aristotle, *Meteorology*, 3.4; Pliny, *Natural History* (= *HN*), 37.16. Cesalpino, *De medicamentorum*, 1.18, 261v: "Ex quibus patet, cur viridis color maxime omnium aciem oculorum reficiat et oblectet […] qui numquam satiat, semper gratus: ratio est, quia maxime in medio consistit inter album et nigrum."

115 Cesalpino, *De medicamentorum*, 1.27, 266r: "Similem ordinem colorum vult Galenus etiam considerari in caeteris corporibus, dummodo eiusdem sint generis. "

116 See Boehm, "Couleur," 77–96.

117 Cesalpino, *De medicamentorum*, 1.27, 266r: "Patet autem primum in fructibus, cum maturantur, transeunt enim ex colore in colorem, ut in caliditatem. Cum adhuc acerbi sunt, virides spectantur, maturescentes autem, quidam albi fiunt […]. Quod et de vino testatur Galenus […]. Flavum enim et ruffum et rubrum calidiora esse albo."

tradition concerning colors, to the extent that they played an ancillary role to flavors and odors in appraising drug properties.

4 Conclusion

The pharmacological explanations of drug powers offer a fresh perspective on the relationship between temperament and the senses in Galenic medicine. It has been argued that the need to determine the properties of drugs led physicians to hone the understanding of temperament according to the sensory characteristics of bodies. These powers were framed in the classification of three or four faculties, which were related to the temperament, matter, and substance of drugs. In the late Renaissance, Galenic physicians such as Jean Fernel and Andrea Cesalpino discussed these faculties according to the medical tradition.

As a key figure of Platonic medicine in the late Renaissance, Fernel inherited much from Avicenna's views on the properties of bodies, including their temperament and substantial form. Along the lines of the *Canon*, he espoused the view that the temperament of drugs was not only indicated by the primary qualities but also by sensory properties, above all, taste. Such a statement followed the medieval conception of taste as the sense par excellence to assess the temperament and texture of drugs. The latter corresponded to the first and second faculties of drugs, which both came from the mixture of elements. Along with temperament, the substantial form of bodies raised original considerations in Fernel's pharmacology. Having a celestial origin, the substantial form was associated with the total substance and the third faculties of drugs. Remarkably, Fernel stated that these faculties could be known by experience in the case of distillates. The latter, indeed, were recognizable by their strong odor, flavor, and color, and denoted medicinal faculties that had been put forward through the alchemical notion of quintessence.

For his emphasis on the celestial origin of the substantial form, Fernel's pharmacology contrasted with the 'materialistic' views of Aristotelian physicians in the Renaissance. Cesalpino buttressed this stance for his focus on the elemental constitution of tangible bodies. To him, all the faculties of drugs came from the mixture of their elements and their material conditions. Remarkably, in stating four types of drug faculties and the elemental nature of the total substance, Cesalpino's interpretation was much indebted to Averroes's pharmacological theory expounded in the *Colliget*. Moreover, his account of drug faculties was particularly informative in showing the epistemic role of the senses in Galen's *On Simple Drugs* and in Aristotle's natural

philosophy, especially in *On the Senses* and *On the Soul*. As Cesalpino recalled, taste was prominent for its status as a contact sense. In contrast, odors and colors, because they were less tangible sensations, played a less important role in assessing the temperament of drugs. At any rate, Cesalpino considered to what extent these sensory properties revealed the temperament and density of bodies according to their structure in elemental parts and in the process of natural change.

Whether in a Platonic or Aristotelian framework, the interpretations of Fernel and Cesalpino offered a stimulating treatment of the medical tradition on the senses. First, their accent on taste confirmed the primacy of touch for assaying temperament, while encompassing taste as a contact sense. Moreover, they suggested that taste, color, and odor gave insight into both the physical nature of drugs – in quality and in texture – and the strength of their total substance. In articulating the temperament of bodies with their substance, these sensory properties allowed physicians to encompass both 'manifest' and 'occult' qualities and, more broadly, the terrestrial and celestial realms in their understanding of the body.