



PALGRAVE STUDIES IN MEDIEVAL AND  
EARLY MODERN MEDICINE



# Hylomorphism into Pieces

Elements, Atoms, and Corpuscles  
in Natural Philosophy and Medicine,  
1400–1600

*Edited by*  
Nicola Polloni · Sylvain Roudaut

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# Palgrave Studies in Medieval and Early Modern Medicine

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# Hylomorphism into Pieces? Introductory Remarks

*Nicola Polloni and Sylvain Roudaut*

## 1 RESHAPING THE NARRATIVE

For centuries, hylomorphism ruled over Western philosophy and science. From the emergence of the first universities in Europe to the early modern era, the notion that natural bodies are composed of matter and form represented the prevailing theory of nature in the later Middle Ages. However, hylomorphism faced its share of challenges, which gradually surfaced during the later Middle Ages.

A common narrative in the history of both philosophy and science asserts that the seventeenth century witnessed the abrupt decline of hylomorphism, coinciding with the decline of Aristotelianism. Atomist and corpuscular theories of matter (if we choose to designate ‘corpuscular’ as a theory that explains the structure of bodies and natural processes

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through interactions among minute material constituents without necessarily assuming the existence of a void) came to supplant the long-dominant hylomorphic perspective. Philosophers and scientists such as Descartes, Galileo, and Gassendi, to name just a few, believed that ‘true’ philosophy should dispense with the venerable Aristotelian doctrine of matter and form. This narrative possesses a degree of vagueness and excessive generality, and its validity extends only up to a certain point. In addition, it remains incomplete, misleading, and significantly inaccurate to a large extent.

The rejection of hylomorphism as an explanatory framework for the constitution of natural bodies can be attributed to the influence of alternative explanations regarding the internal structure of such bodies. However, it is a misconception to assume that the rejection of hylomorphism in the seventeenth century resulted from a sudden and complete replacement.

The resurgence of Lucretius’s *De rerum natura* in the early fifteenth century, followed by increased access to other Greek Antiquity materials in the sixteenth century, sparked new ideas concerning the structure of bodies and the nature of explanations needed for natural processes. During approximately two centuries, spanning from 1400 to 1600, many philosophers did not necessarily believe that atomist and corpuscularian theories were inherently incompatible with hylomorphism. Instead, they formulated original philosophical doctrines that integrated these two frameworks.

When viewed through the lens of the history of both philosophy and science, this fact is somewhat unsurprising. Much like other significant conceptual shifts in the history of philosophy, the departure from the Aristotelian framework largely represented the culmination of a gradual evolution in the conception and application of matter and form as speculative tools. However, opting for a gradualist perspective rather than the abrupt replacement narrative commonly associated with figures like Gassendi, Galileo, and Descartes would still be a simplified explanation.

Even in the late sixteenth century, many proponents of hylomorphism continued to believe that the Aristotelian principles of matter and form could be reconciled with the emerging insights of modern physics, not to mention the enduring presence of a robust scholastic tradition firmly rooted in this doctrine well into the seventeenth century. The various inventive ways in which corpuscular theories and hylomorphism coexisted during the transitional period between the late Middle Ages and the early

modern era gave rise to intriguing philosophical hybrids. Among these, one of the most peculiar entities in the Western philosophical tradition emerged: Aristotelian atomism.

In a noteworthy passage from his work known as the *Exigit ordo*, where he elaborated on his theory of atoms, Nicholas of Autrecourt, often regarded as the most significant representative of atomism in the Latin Middle Ages, observed that the concept of ‘form,’ understood in the Aristotelian sense as a correlate of matter, could potentially refer to a binding relationship occurring between atoms:

Perhaps there is something there which connects and retains the indivisibles in this union, as a magnet does with iron. The stronger the force of this thing, the longer the subject survives as a subject. If there were a force of this kind, it would be called the quasi-formal principle of the thing (*quasi principium formale rei*).<sup>1</sup>

Nicholas of Autrecourt believes it is plausible to equate ‘form’ with a specific type of force responsible for the cohesion of unified combinations of atoms. This attribution of a role to the hylomorphic model in explaining nature, even by a philosopher like Autrecourt, who was drawn to atomism, underscores its significance for medieval thinkers who did not always view alternative theories of matter as inherently contradictory to it. As recently highlighted by Christoph Lüthy and Elena Nicoli, the apparent dichotomy between atomism—or we might say, ‘corpuscularianism’ in a broader sense—and hylomorphism is largely a construct of history: ‘Atoms *versus* forms: in the course of the seventeenth century, this pair of opposites gradually hardened into a rigid dichotomy. Our historiography tends to define the opposition even more sharply, in terms of “atomism *versus* hylemorphism.” The addition of this suffix “-ism,” has the effect of turning an opposition of concepts into an opposition of ideologies or worldviews.’<sup>2</sup>

Lüthy and Nicoli observe that such a sharp opposition is absent in the extensive writings discussing concepts of atoms, corpuscles, particles, or *minima* before the year 1600. Moreover, the two terms at the heart of this opposition are largely constructs of historiography. While the term ‘atomism’ only emerged in the fifteenth century and was not used to refer

<sup>1</sup> Nicholas of Autrecourt (1971, 63).

<sup>2</sup> Lüthy and Nicoli (2022, 7).

to a specific school of thought at that time, the term ‘hylomorphism’ was coined by nineteenth-century historians who initially employed it to characterise certain materialist doctrines.<sup>3</sup> The very concept of materialism, with which hylomorphism is frequently contrasted in contemporary historiography, did not exist as a philosophical concept in the Middle Ages. While the inclination to categorise diverse philosophical and scientific doctrines under a single label may be tempting, it carries inherent challenges that historians of both philosophy and science should be mindful of.

These considerations render the narrative of late medieval and early modern theories of matter far more intriguing than the conventional account suggests. The manner in which hylomorphism waned in popularity, yielding ground to novel explanations of nature rooted in the microscopic world of material particles, likely serves as a paradigmatic instance of what historians of ideas occasionally term—albeit with some controversy—a paradigm shift. To this extent, the story of how hylomorphism crumbled constitutes a foundational case study in understanding how philosophical and scientific frameworks evolve at the intersection of philosophy and science. Furthermore, it underscores the pivotal role that new theories of matter played in the ascent of modern scientific rationality.

The significance of this case study extends even further. Unlike the paradigm shift that marked the abandonment of the Aristotelian-Ptolemaic model in astronomy, the gradual substitution of corpuscularian theories for hylomorphism involves a fundamental reconfiguration of how fields of knowledge were conceived and sciences were classified.

Hylomorphism, indeed, constitutes a *metaphysical* theory concerning the unity of material objects, their persistence over time, the similarities among individuals of the same species, and the stability and regularity observed in nature. But hylomorphism also operates at the *physical* level, explaining the composition of natural bodies. In this capacity, it aims to elucidate the cohesion of material components within entities that an Aristotelian would term ‘substances.’ It also seeks to account for the way in which things can reproduce themselves by transmitting a form within a particular portion of matter, while also addressing the many interactions of physical entities, including those unique interactions termed ‘perception’ and ‘knowledge.’

<sup>3</sup> See Lüthy and Nicoli (2022, 8).

The physical and metaphysical roles of hylomorphism were intricately interwoven within the Aristotelian tradition(s). The collapse of this framework did not merely signify a shift in isolated facets of natural philosophy; rather, it resulted in a profound restructuring of scientific discourse and a re-evaluation of the theoretical status of concepts related to matter and the structure of bodies. In essence, it marked a pivotal transition in the way the process of ‘explaining’ nature is conceived.

## 2 MATTER AND FORM

The narrative of the shift that led to the departure from hylomorphism in early modern Europe commences with the initial encounter with competing theories that had emerged centuries prior. How were the new theories of matter received and integrated into the still-dominant Aristotelian vocabulary of the time? To what extent did philosophers of the fifteenth and sixteenth centuries, including some scholastic thinkers, attempt to reconcile hylomorphism with these new theories of matter? To comprehend this juncture, we must examine how both hylomorphism and its competitors function in their explanations of nature.

The hylomorphic theory seeks to elucidate the structure and operations of natural entities through the combination of two inseparable principles: matter and form. Metaphysically speaking, this composition represents the most fundamental relationship constituting the essence of natural objects. In contemporary terms, we could describe hylomorphism as favouring a ‘top-down’ approach to elucidating the structure of things. According to the hylomorphic model, the constituent parts of an entity (e.g., an animal’s organs) are defined by the form that imparts unity and specific properties to the material components. The nature of an entity’s material constituents depends on the identity of the whole, whose unity derives from the form inherent in the matter. Aristotle’s perspective primarily focuses on how wholes are organised by a unifying principle referred to as ‘form.’ This is why, within the Aristotelian framework, living beings are often considered paradigmatic examples of substances, as they exhibit a higher degree of unity compared to inanimate entities.

Following this approach, most scholastic philosophers, like Thomas Aquinas, John Duns Scotus, and William of Ockham, among many others, assert that the essence of every physical substance corresponds to the union of prime matter and substantial form. Although scholasticism historically debated whether prime matter possessed inherent actuality,

there was a broad consensus that matter is utterly in potency to any substantial form. When united with prime matter, the substantial form actualises the hylomorphic compound. In doing this, the substantial form ‘shapes’ the compound, providing it with its specific powers and features. Prime matter, in turn, is usually conceived as completely formless and often considered dimensionless and unknowable in itself.

The combination of prime matter and substantial form gives rise to an individual bodily substance that, despite its metaphysical composition, exists as a unified entity. This substance also exhibits discernible characteristics, which are provided by a set of accidental forms that adhere to it and explain the observable features of the substance within the framework of the accidental categories. As a consequence, physical substances are hylomorphic compounds consisting of two distinct metaphysical components.

This foundational premise yields a dual perspective in our understanding of such substances. We can explain their constitution from a *physical* standpoint. A body invariably consists of integral parts, some of which fulfil the functional role of matter. For instance, consider the body of a squirrel, composed of various organs that, in Aristotelian terms, are uniform bodies like flesh, humours, and bones. These uniform bodies result from the balanced interplay of the four elements, leading to elemental mixtures. Conversely, physical substances can also be explained from a *metaphysical* standpoint as being formed by a single substantial form (in this instance, the soul of the squirrel) and prime matter. At first glance, these two methods of describing the composition of bodies may appear complementary, aligning with the distinct orientations of their respective disciplines: a physical explanation for natural philosophy and a metaphysical description for ontology. However, within the scholastic framework of knowledge, the metaphysical description takes precedence over the physical analysis.

This epistemological priority becomes evident when we delve into scholasticism’s elucidation of substantial change. When must transforms into wine (a process akin to fermentation and regarded as substantial change in Aristotelian terms), scholastic philosophers posit that the must undergoes corruption while wine is generated in its stead. Generation and corruption constitute two facets of a unified process involving two opposing species: one species ceases to exist while the other comes into being. Since both must and wine derive their identities from their substantial forms, which confer upon all substances their distinct powers and

specific attributes, Aristotelian thinkers maintained that substantial change occurs when the form of the must is destroyed, and the form of the wine is generated. However, for this process to occur, these forms necessitate a persistent subject in which the agent of change operates. This subject allows us to assert that the must has become wine, and that the wine was once must. Without granting such a continuity in the process, generation and corruption would be two separate processes akin to creation and annihilation, respectively.

This persisting subject is prime matter, the only subject to which substantial forms can unite to constitute a substance. Thus, the explanation of substantial change, the most characteristic kind of transformation happening in nature, is given metaphysically by recurring to the metaphysical parts that constitute natural substances and that indeed serve as the fundamental principles of nature.

### 3 LATE SCHOLASTIC HYLOMORPHISM (1400–1600)

The shift from central to later scholasticism was characterised by a series of gradual amendments to the hylomorphic theories that had been developed within the earlier tradition. Understanding these modifications is essential for comprehending the framework within which most of the figures discussed in this volume operated.

Let us recall two of the most significant amendments. Firstly, as Dennis Des Chene has emphasised, later scholasticism largely embraced Duns Scotus's perspective concerning the condition of prime matter.<sup>4</sup> With the exception of the Dominican Thomists, few later scholastic thinkers (among whom, notably, the Coimbra commentators) fully adhered to Aquinas's assertion that prime matter is a pure potency. Instead, the list of philosophers who endorsed Scotus's stance includes Francisco de Toledo and Francisco Suárez, whose works were studied by many seventeenth-century anti-Aristotelian philosophers such as Galilei and Descartes.

According to this perspective, prime matter is in act with respect to itself and in potency only in relation to formal actualisation. While this assertion does not inherently imply a physicalisation of prime matter and was primarily motivated by the challenges associated with positing a pure

<sup>4</sup> See Des Chene (1996, 81–121).



potency as the subject of substantial change, it did introduce some ‘thickness’ to this entity, adopting the terminology proposed by Pasnau.<sup>5</sup> This process facilitated its reinterpretation as a physical and integral component of natural entities.

Secondly, in later scholasticism, it was often asserted that certain types of accidents could inhere directly in prime matter rather than the compound, as prescribed by Aristotle. This assertion aligns with the considerations of substantial change discussed earlier. Allegedly, when must transforms into wine, all the accidents of the must (such as its colour, taste, and physical extension) are first destroyed and then regenerated in the wine. Aquinas, for instance, held this perspective, asserting that accidents could only adhere to substances.

However, many later scholastic philosophers deemed it unnecessary for these accidents to be regenerated when, for example, the redness of the must appears to remain the same in the wine into which the must is transformed. Their solution was to allow some of these accidents (specifically those shared by both endpoints of substantial change) to directly inhere in prime matter, enabling them to be preserved alongside it throughout the process. In the late Middle Ages, this perspective had gained such widespread popularity that by the early sixteenth century, the Spanish philosopher Luis Coronel described it as the ‘prevailing consensus’ on the topic of accidents. As a matter of fact, this view was championed by influential thinkers of the sixteenth century, such as Francisco de Toledo. Other requirements typical of the physical application of hylomorphism, such as the ‘adaptation’ of prime matter to receive a specific form, seemed to imply a similar scenario. These trends eventually gave rise to a clear differentiation between prime matter and proximate matter, with the latter representing portions of prime matter endowed with accidents, essentially the ‘normal’ condition of prime matter in nature.

Yet, the later debate on prime matter encompassed and explored various possibilities. One of the most intriguing issues that characterised the discourse on this entity during the early modern period revolved around its relationship with extension. It seems quite apparent that matter is directly connected to the three dimensions: we commonly characterise an object’s physicality in terms of its matter, and matter appears to be

<sup>5</sup> See Pasnau (2011, 6–11).

the most conspicuous factor distinguishing between spiritual and corporeal substances. Yet a question arises: is prime matter, on its own, already extended into the three dimensions? Posing this question prompts us to ponder the relationship between matter and quantity since for something to be extended implies that its parts are situated one after another. Robert Pasnau's taxonomy proposes four distinct answers to the question of prime matter's extension, which were still debated in the later Middle Ages, gradually leaning towards the claims that matter is extended either by itself or by virtue of its ontological connection to quantity.<sup>6</sup>

One of the most noteworthy examples of this perspective on matter is that of Jacopo Zabarella. A defining feature of his natural philosophy is the assertion that prime matter is inherently extended into the three dimensions. In other words, prime matter possesses bodily characteristics. Interestingly, Zabarella combines this assertion with another radical stance inherited from Aquinas: that prime matter is a pure potency. In his chapter, Fabrizio Bigotti analyses the reasons behind Zabarella's claim regarding the intrinsic extension of prime matter and its conceptualisation as a body with indeterminate dimensions. The influence of Zabarella's theory was far-reaching. As Bigotti emphasises, traces of his concepts directly impacted many Italian natural philosophers, including Paolo Sarpi, Girolamo Fabrici da Acquapendente, Santorio Santori, and eventually reached Galileo Galilei. This physicalisation of prime matter, in turn, facilitated its accommodation within various, often non-Aristotelian, accounts of nature, particularly in connection with emerging corpuscularian tendencies.

However, the intriguing amalgamation of claims that prime matter is a pure potency and inherently possesses the three dimensions was not exclusive to Zabarella and his Italian followers. Thomistic inclinations endured in later scholasticism, especially among Dominican authors. As Russell Friedman highlights in his chapter, Domingo Báñez provides an illustrative example of this perspective in the sixteenth century. Like most Dominicans, Báñez perceived prime matter as a pure potency. Nevertheless, Báñez's attempts to elucidate how matter can simultaneously be a sheer potency and quantified reveal that amendments and reassessments characterised later Thomistic developments. Although marked by distinct characteristics, discernible trends towards the physicalisation of

<sup>6</sup> See Pasnau (2011, 53–76).

prime matter were, to some extent, shared by both Aquinas's and Scotus's conceptions of this entity in later scholasticism.

A third clear example of this perspective is presented by the Jesuit philosopher Rodrigo de Arriaga, as discussed in Erik Åkerlund's contribution. On one hand, Arriaga still adheres to the core tenets of Aristotelian hylomorphism as envisioned by earlier Jesuits like Suárez. Accordingly, albeit a metaphysical entity, prime matter possesses some intrinsic actuality and, thus, can exist by divine power without the substantial form. On the other hand, however, Arriaga delves into the intrinsic structure of this entity in a peculiar manner. After assuming that prime matter is always quantified (meaning it is always extended into the three dimensions) because matter and quantity are identical, Arriaga speculates about the possible state of matter if it were not extended. The Jesuit philosopher appears to attribute a point-like structure to prime matter when considered abstracted from its implicit extension: in this scenario, matter could (but does not necessarily have to) be reduced to a point, which, for Arriaga, constitutes the basic component of lines and surfaces. As Åkerlund emphasises, this analysis of prime matter is directly linked to Arriaga's 'Zenonist' (i.e., anti-Aristotelian) consideration of the continuum as being composed of a finite number of indivisible parts.

Just like the notion of matter, the concept of form underwent significant changes from the late Middle Ages to the late sixteenth century. Without oversimplifying the diversity of conceptions stemming from various philosophical traditions, especially in the sixteenth century, it is fair to say that the dominant theory of bodies during this period posited the two Aristotelian principles of matter and form to explain their structure.

However, the commonality of the terminology of 'form' conceals crucial conceptual differences. The various roles attributed to form by Aristotle, ranging from metaphysical functions to practical applications, in conjunction with the Platonist influences inherent in the medieval theories of divine ideas and exemplars, allowed for some flexibility in the way forms were conceptualised. A noticeable trend in the late Middle Ages was to emphasise the physicality of forms, particularly from the late thirteenth century onwards. Distancing themselves from Platonist views, many philosophers regarded forms as extended entities possessing integral parts, i.e., quantitative components. Admittedly, some types of forms were still conceived as non-extended. When it came to the 'forms' (or exemplar causes) present in the divine mind, human intellectual souls, or angels, which were generally defined as particular types of forms, the prevailing

position was to consider these forms as non-extended. However, other types of forms, including those forms that are the souls of non-human animals, were often conceived as physical entities with extended parts (having a *partes extra partes* structure, according to the medieval term of art). This perspective, which emerged in the thirteenth century as a somewhat unorthodox interpretation of forms, was upheld by some of the key figures in philosophical thought between the fifteenth and seventeenth centuries, ranging from Paul of Venice in the early fifteenth century to Francisco Suárez in the late sixteenth century.

In the sixteenth century, when confronted with philosophical doctrines claiming to explain nature without substantial forms, thinkers like Francisco Suárez and the influential Coimbra commentators typically argued for the existence of these forms by highlighting their supposed physical effects rather than relying solely on metaphysical arguments. During this period, forms had become a conceptual tool used to elucidate the reality of otherwise inexplicable forces operating in nature. This emphasis on the physical activity of forms further solidified their increasingly concrete status.

It is essential to emphasise that the two centuries preceding the seventeenth century witnessed a rich array of new philosophical influences integrated into a wide variety of scientific and philosophical systems. In particular, alternative conceptions of forms as more abstract intelligible principles experienced a revival of interest during the Renaissance due to a resurgence of Platonism. Therefore, the evolution of the notion of 'form' described here should be seen as a general *tendency* within the late medieval and early modern Latin tradition.

This tendency brought about significant changes in the understanding of the nature of hylomorphic composition and its relationship to various aspects of natural philosophy. As mentioned earlier, hylomorphic composition represented a type of metaphysical relation distinct from the integral composition of material parts characterising natural bodies. The concept of form as an essential part of the composite was originally intended to explain the metaphysical unity of a thing. However, asserting that forms *themselves* possess extended parts blurs the distinction between these two types of composition to some extent. As Henrik Lagerlund demonstrates in his contribution, this thesis about the composition of parts internal to forms resulted in new philosophical puzzles when all its logical consequences were taken seriously.

While the standard conception of identity based on the hylomorphic doctrine held that an individual remains the same across time as long as it has the same form—while its matter can change—the conceptualisation of forms as having extended parts compelled philosophers to find new ways to account for the identity of individuals over time.

This point raised another set of issues concerning the ultimate components of forms. If a form is genuinely composed of parts, is it infinitely divisible into parts of the same kind, or is there a limit beyond which a form cannot exist in matter anymore? As shown by Roberto Zambiasi in his contribution, the evolution of the philosophical problem of *minima*, i.e., the minimal limits of bodies, was intrinsically connected to the development of hylomorphism in the Latin world and this partitional conception of forms.

Attributing parts to forms also posed a challenge to the type of explanation that forms were supposed to provide. One of the primary objectives of the hylomorphic worldview was to offer a top-down approach to explain natural things and to avoid the undesirable consequences of purely corpuscular accounts. However, viewing forms as composed of parts opened the door to another perspective, wherein their identity became dependent on their constituents. This reintroduced a scheme of explanation within the hylomorphic framework that it was meant to circumvent.

These new characteristics of late medieval and early modern theories of forms did not completely diminish the appeal of hylomorphism as the best way to explain the structure of bodies. As evident from the fact that, from the late thirteenth century when figures like Peter John Olivi, Richard of Middleton, or John Duns Scotus began attributing parts to forms, several centuries passed before the eventual decline of hylomorphism. However, this evolution clearly influenced the debates surrounding the structure of natural things, making the articulation of hylomorphism with other types of composition more complex. This complexity eventually peaked in the two centuries preceding the emergence of the so-called Scientific Revolution.

#### 4 ELEMENTS AND MIXTURES

The late scholastic updates to the hylomorphic model are closely connected to another type of physical explanation proposed by Aristotle in his natural works. As mentioned earlier, a physical description of complex

bodies posits that they are composed of simpler, uniform bodies. In Aristotelian terms, these are known as elemental mixtures: uniform bodies resulting from the interactions of the four elements (fire, air, water, and earth) and their powers (heat, coldness, dryness, and moisture). The relationship between these two types of entities—elements and mixtures—gave rise to a set of challenging issues within the Aristotelian tradition and its subsequent development in scholasticism.

The four elements are the simplest bodies in the universe. Due to their foundational role, these elements provided pre-modern philosophers with a valuable explanatory framework. In certain instances, as Claire Murphy elucidates in her chapter, thinkers such as Nicholas of Cusa adopted a numerological approach to establish a connection between God's creative intentions and the fundamental building blocks that appear to underlie the universe. However, Aristotelian philosophers primarily regarded the elements as explanatory tools used to justify the fundamental accidental qualities observed in natural substances, most of which were linked to the primary qualities of the elements.

The elements constantly transmute, and according to scholasticism, their transformation, like all other forms of substantial change, occurs within prime matter. While scholastic philosophers generally assumed that elements possessed substantial forms (a point that posed difficulties for earlier Greek Aristotelians), they also contended that most of the natural world consists of mixtures rather than pure elements. In their pure state, the elements are primarily located at the outermost regions of the universe; for example, the earth element is found at the centre of the universe.

The world therefore consists of elemental mixtures: uniform bodies that make up more complex physical structures, like the body of the squirrel mentioned earlier. As Nicola Polloni explains in his chapter, due to their uniformity, these mixtures can be further divided into smaller pieces that exhibit the same characteristics—they are the same substance but in a smaller form. Although they contribute to the formation of the mixtures, the elements cannot be considered integral components of them. If they were, the mixture would lose its uniformity and instead become a collection of individual elements.

As detailed by Luca Burzelli and Nicola Polloni in their respective chapters, scholastic philosophers typically argued that after influencing the mixture, the elements only persist within this newly generated substance according to their powers. This 'virtual' presence involves the transfer of

the four elemental qualities to the mixture and its substantial form, while the matter at both endpoints of change remains unchanged. Once again, a physical process—the generation of mixtures—is described in metaphysical terms, aligning it with an amended version of the hylomorphic theory.

We can now gain a better understanding of why the theory of elements posed challenges when reconciling with hylomorphism. In contrast to hylomorphism, the theory of elements adopts a bottom-up approach to explain the composition of natural entities. While Aristotle incorporated this theory into his philosophy of nature, he did not explicitly outline the relationships between the composition inherent to the elements and the composition of matter and form found in all beings, leaving a complex issue for his readers and later interpreters to grapple with. Does the nature of a thing depend on its ultimate constituent parts, or is it primarily derived from the unifying form that defines its identity? If a substance is truly composed of different elements, how can it maintain its essential unity, as required by the unifying form? Anneliese Maier identified in this final problem a dilemma without a solution, highlighting the inadequacy of Aristotelianism as an attempt to reconcile two fundamentally irreconcilable theories of composition.<sup>7</sup> Despite its numerous merits, including a well-informed character supported by an impressive array of sources, Maier's analysis primarily focused on the thirteenth and fourteenth centuries, omitting the conclusion of this narrative, namely, the transitional period between 1400 and 1600, during which Aristotelianism permanently ceased to be the prevailing view.

Although scholars who have delved into the theory of elements have acknowledged its connection to the hylomorphism problem, they have generally followed Maier's emphasis on the thirteenth and fourteenth centuries, leaving largely unexplored the developments of the fifteenth and sixteenth centuries. The challenge of harmonising hylomorphism with other forms of composition clarifies that, given the late medieval evolution of hylomorphism as described earlier, this problem reached its peak complexity precisely during this period. Hylomorphism's effectiveness in offering ontological justifications for what we observe in nature originated from its consistent readiness to revise its metaphysical assumptions in

<sup>7</sup> See Maier (1952, 3–5).

order to ‘save the phenomena.’ However, from a certain perspective, this continual re-evaluation also paved the way for its eventual supersession.

The concept of proximate matter, invested with actuality and accidents, accentuates its ‘physicality.’ Proximate matter, indeed, shares some characteristics with substances without being one, and appears to be the ‘true’ subject of substantial change within the course of nature. Simultaneously, the theory of elemental mixtures appears to give rise to two significant implications. Firstly, the elements seem to function mostly as potential metaphysical components of substances (which are composed of mixtures, not elements) and possess actual, physical existence only when they are not virtually present in a mixture. Consequently, we find ourselves dealing with two sets of metaphysical constituents for bodies—matter and form on one hand, and the elements on the other—whose interrelation appear challenging to rationalise. Secondly, mixtures appear to be the fundamental building blocks of the reality we encounter in our everyday lives. They represent the lowest degree of physical composition for complex bodies when considering their integral components.

As we have seen, according to the main representatives of late scholasticism, such as Francisco de Toledo and Francisco Suárez, substantial change occurs when the substantial form is substituted with another. These forms can only join matter, which has the potency to receive them. Yet, if this matter is in act in a certain way and is also always joined to some accidental forms, why should we regard it as a metaphysical *part* of substances? Likewise, if we assert that the elemental theory can explain qualities like heat, dryness, or colour, why must we exclude the possibility that the elements are physical, integral components of bodies? Finally, if we concede that complex bodies can be reduced to uniform, simpler constituents, why should we not argue that their functioning is determined by the way these constituents are assembled and superimpose instead a further structure?

The answer to all these questions is one and the same: it is the substantial form and the main principles underpinning its functioning in hylomorphism that impose a metaphysical description of physical change. If we remove or curtail the functions attributed to the substantial form, we may find ourselves asserting the existence of a *physical* substrate shared throughout the entire universe, suggesting that natural objects are composed of minuscule physical blocks (elements, corpuscles, or atoms) as their *integral* parts, and proposing that the behaviour of all bodies can be explained by the specific *arrangement* of these integral parts. However,



without the substantial form, hylomorphism dissolves into materialism or physicalism.

## 5 ATOMS AND CORPUSCLES

When Aristotle wrote his main works where the hylomorphic theory was put into use (*Physics*, *On the Soul*, *Metaphysics*), alternative explanations of complex objects such as living beings were available. Besides the theory of elements, atomist theories like those of Leucippus and Democritus were also known to Aristotle, although he expressed a fierce opposition to these doctrines. As a matter of fact, atomist theories offer a conception of natural bodies seemingly opposed to hylomorphism. In an atomist framework, the whole depends on the minimal material parts composing it, whatever these parts may be. Like the theory of elements, atomism and, more broadly, corpuscularianism advocate a bottom-up approach to composition, which appears to be in significant contrast with hylomorphism. Without necessarily denying the reality of the things composed of material parts, atomists and corpuscularists see complex bodies as derivative upon their parts and, in this respect, do not acknowledge any essential difference between inanimate and animate beings.

The historical development of medieval and early modern corpuscular theories is notably intricate. Fortunately, in contrast to the dearth of studies mentioned earlier on theories of elements in the same period, recent scholarship on this theme has made significant advancements.

In 2001, a volume published by Lüthy, Murdoch, and Newman rapidly achieved classic status.<sup>8</sup> This volume included crucial contributions to the field and established new research directions for tracing the origins of modern atomism and corpuscularianism. Although it primarily focused on the early modern period, this volume also underscored how crucial aspects of the new corpuscular theories were influenced by medieval developments in indivisibilist mathematical conceptions of the continuum.

In 2009, another volume edited by Grellard and Robert delved more directly into the medieval period.<sup>9</sup> This volume focused on the thirteenth and fourteenth centuries and brought to light poorly studied figures of

<sup>8</sup> See Lüthy et al. (2001).

<sup>9</sup> See Grellard and Robert (2009).

the Middle Ages, such as Gerard of Odo or William Crathorn. One of the main results of this collection of studies was to establish that the types of atomism advocated in the Latin tradition before the early modern era could not be solely circumscribed to mathematical indivisibilism (or pointillism) but also comprised physical theories based on the existence of indivisible corpuscles in nature.

The recent publication by Lüthy and Nicoli of a new volume on the development of corpuscularianism across various scientific disciplines in Renaissance thought aligns with the increasing body of work produced by historians of science regarding the period immediately preceding the so-called Scientific Revolution.<sup>10</sup> This volume specifically underscores the significant role played by various fields intimately connected with natural philosophy, notably medicine, meteorology, and chemistry, in the emergence of corpuscularianism amidst the vibrant array of new doctrines that characterised the sixteenth century.

The advancement of scholarship on late medieval and early modern corpuscular theories of matter has substantially altered the perception of a sudden resurgence of atomist ideas starting in the fifteenth century. In the Latin West, the notion of a ‘revival’ of atomism in the fifteenth and sixteenth centuries is somewhat misleading, as atomistic concepts had never entirely vanished from discussions concerning the composition of matter, even in the periods predating the focus of the studies collected in this work.

Concerning the Latin medieval tradition, scholars’ focus—even those willing to challenge the alleged discontinuity between the Middle Ages and the modern era—on the thirteenth century and the fourteenth century has led to the neglect of the role and influence of earlier developments, especially those of the twelfth century. This emphasis may be misguided, as many philosophical directions taken by thinkers from the fourteenth century onwards were already anticipated in the twelfth century.

Versions of atomism, ranging from full-fledged physical atomism to indivisibilist conceptions of the structure of the continuum, were advocated in the twelfth century by thinkers such as William of Conches, Adelard of Bath, William of Champeaux, Peter Abelard, Thierry of Chartres, and Hugh of Saint Victor. Even during the thirteenth century,

<sup>10</sup> Lüthy and Nicoli (2022).

a time marked by the extensive incorporation of the recently rediscovered Aristotelian corpus into the context of Christian philosophy, several thinkers exhibited a distinct fascination with atomist hypotheses. They made efforts to reconcile these atomist ideas with the core texts of Aristotle's doctrine.

As Aurélien Robert's study shows, a group of commentators active at the Arts faculty of Paris in the last third of the thirteenth century proposed versions of atomism within the context of commentaries on Aristotle's *On the Soul*. An important characteristic of these texts is that, much more clearly than the mathematical indivisibilism of Robert Grosseteste in the thirteenth century, these authors presented a *physical* version of atomism based on arguments not directly connected to the controversy over the structure of the continuum that would develop more intensely in the fourteenth century. To a significant extent, the doctrines that we can characterise as 'atomist' or 'atomistic' in the fifteenth century are indicative of the continued pursuit of philosophical convictions and methodologies that had existed long before this era. These earlier ideas had, for a time, been somewhat eclipsed by the reception of new translations of Aristotle's works, as well as the writings of Islamic and Jewish Aristotelians such as Avicenna and Averroes.

## 6 CORPUSCULARIANISM: A METAPHYSICAL STANCE?

Revising traditional narratives about the history of corpuscular theories entails the challenging task of providing a more precise delineation of this story. The recent observations regarding the enduring influence of themes that emerged as early as the twelfth century, particularly within the Latin tradition, may extend beyond atomism or indivisibilism in natural philosophy. They can be applied more broadly to encompass a spectrum of metaphysical positions that resist adopting a top-down approach to material composition and are more in line with the bottom-up perspective that characterises corpuscular theories in general. While these views may not fit squarely within the unequivocally atomist theories defended in the twelfth century, the perspectives on the indivisible parts of material substances held by thinkers like Peter Abelard could reasonably be categorised as 'corpuscularianism.' However, questions arise: Can we refine this characterisation further? In the effort to refine the history of the theories concerning natural bodies, to what extent should we consider the metaphysical foundations that accompanied corpuscular theories?

The relationship between atomism or corpuscularianism and the underlying metaphysics is a complex and debated issue. Some scholars, such as Robert Pasnau, have proposed replacing the historiographical term ‘nominalism’ with ‘corpuscularianism.’ They argue that this concept encapsulates the notion that nothing exists beyond individual material substances and their constituent parts, a philosophical viewpoint consistently championed by various thinkers from the twelfth century to the sixteenth century.<sup>11</sup> Others have contested this label and prefer to retain the term ‘nominalism’ to keep logical and physical issues separate while acknowledging the enduring influence of the twelfth century in this narrative.<sup>12</sup>

Without denying the importance of expanding the scope of research to achieve a more comprehensive understanding of the general trends that shaped medieval thought, the evolution of theories of bodies from 1400 to 1600 highlights the highly problematic association of corpuscularianism and atomism with ‘nominalist’ doctrines. This association is even more contentious than for the preceding period.

In the twelfth century, William of Conches formulated his theory of matter against a backdrop of Platonist metaphysics. Later, in the fourteenth century, after the Latin West had assimilated the newly translated works of Aristotle and Platonism had receded, a few proponents of atomism, such as Nicholas of Autrecourt and John Wyclif, put forward explicit versions of Platonism concerning essences. Interestingly, some of the most radical fourteenth-century indivisibilists, such as Walter Chatton and Gerard of Odo, were also staunch realists.

The influence of neo-Pythagorean sources, chief among them being Boethius’s *De institutione arithmetica*, adapted from Nichomachus of Gerasa’s *Isagoge*, which proposed an ontology of discrete points, may partially elucidate the unexpectedly realist perspective evident in medieval indivisibilist theorists.<sup>13</sup> However, with respect to the period primarily studied in this volume, the influence of non-Aristotelian sources cannot be regarded as the sole explanation for the frequent and somewhat surprising combination of atomism with robust versions of metaphysical realism.

<sup>11</sup> See Pasnau (2011, 87).

<sup>12</sup> See Normore (2014, 27–35).

<sup>13</sup> On the reception of the Pythagorean tradition in the Middle Ages, see Caiazza et al. (2021).

As Henrik Lagerlund suggests in his study, the scholastic debates surrounding the relation between parts and wholes, often raised in the fourteenth century about the first book of Aristotle's *Physics*, probably played a role in the introduction of corpuscularian theses into the framework of hylomorphism. In particular, the reductionist conception of parts and wholes endorsed by nominalist thinkers like William of Ockham, John Buridan, or Albert of Saxony, led them to orient their understanding of hylomorphism towards corpuscularian interpretations.

Lagerlund presents evidence that the preservation of the quantity of matter, which can be considered one of the foundational principles of corpuscular theories, had evolved into a significant consideration in the development of hylomorphism by the Italian philosopher and logician Peter of Mantua. While not explicitly asserting that the same quantity of matter endures in all material transformations, Peter of Mantua views the conservation of material quantity as an essential prerequisite for maintaining the identity of hylomorphic compounds over time, leading him to revise drastically the distinction between living beings and mere material aggregates that the Aristotelian theory of matter and form was precisely meant to capture. For this particular nominalist trend emerging in the fourteenth century from within the Aristotelian tradition broadly understood, the association of corpuscularianism with nominalism seems more convincing than for the few cases of full-fledged atomist doctrines one encounters in the fourteenth-century Latin tradition, such as those of Nicholas of Autrecourt and John Wyclif.

In contrast, this connection becomes significantly more contentious when examining the specific period under consideration in this volume, namely the fifteenth and sixteenth centuries. Firstly, during the fifteenth century, when the terms *Reales* and *Nominales* began to be commonly used to designate opposing philosophical factions, the belief in indivisible entities, which is integral to atomist perspectives, was frequently linked with the Realist camp. Indeed, as Sylvain Roudaut points out in his contribution on various thinkers associated with the so-called circle of John Mair in the early sixteenth century, there was a belief that the realist approach to semantics for terms like 'point,' 'instant,' or 'indivisible part' obligated one to posit the existence of indivisible entities. In contrast, the nominalist interpretation of these terms was often employed as a means to evade such ontological commitments.

However, as evidenced by the discussions taking place within the circle of John Mair, which predominantly followed a scholastic style,

the realist position was not necessarily considered a metaphysical and semantic doctrine automatically implying indivisibilist views. A realist who subscribes to the existence of indivisibles could argue that the statement ‘there are indivisibles’ is true and can be interpreted straightforwardly, without the need for semantic strategies that reduce the term ‘indivisible’ to divisible objects outside the mind. However, while acknowledging the existence of indivisibles, the realist was not compelled to assert that continuous magnitudes are genuinely *composed* of indivisibles.

The proposal of an atomistic model for natural bodies was influenced by the existence of indivisibles but was not directly mandated by it. This allowed for a significant scope in testing corpuscular theories without necessarily endorsing them wholeheartedly. This approach aligns with the tradition in medieval philosophy, where inquiries into logical possibilities often preceded more radical claims about existence.

This classification of metaphysical positions, however, reveals how, in the scholastic tradition from the fifteenth century onwards, when the ‘Nominalist’ and ‘Realist’ paths (*viae*) became more distinct, these labels began to play a role in addressing issues related to the analysis of physical aspects such as space, time, and material particles. It also underscores the need for caution when systematically associating positions like nominalism and corpuscularianism.

The various ways of defending corpuscularian theories were diverse, allowing for advocacy based on semantic and logical reasoning and, in some instances, connections to doctrines categorised as ‘realist’ or ‘nominalist.’ However, other arguments in support of corpuscularianism had no semantic considerations at their core.

This observation gains further support from the fact that sixteenth-century proponents of corpuscularianism, such as Giordano Bruno, Bernardino Telesio, and Tommaso Campanella, who openly opposed the scholastic tradition, were largely uninterested in the arguments stemming from the classification of philosophical positions just mentioned.

## 7 BEYOND OPPOSITIONS

The opposition between atomism and hylomorphism, as previously explained, is largely a historical construct. Defining what qualifies as true ‘atomism,’ meaning the criteria for an atomist doctrine, has long divided scholars. One common point of agreement is the acceptance of the void as an essential component of the universe, specifically as the medium in