Natural Philosophy, Medicine, and Alchemy

Sixteenth-century natural philosophers and physicians crafted novel ideas on bodies and their internal powers. These ideas often went far beyond the framework of the traditional perspectives, influencing the broader philosophical scene of the sixteenth and early seventeenth centuries. Although the principal actors in sixteenth-century natural philosophy had a variety of motivations and points of departure, many of them were medically educated humanists or humanistically trained physicians. This was the case, for example, for Jean Fernel, Girolamo Cardano, and Julius Caesar Scaliger. Under the influence of these figures, writers such as Bernardino Telesio and Justus Lipsius, though not educated as physicians, took pains to engage in questions related to the medical realm. Their writings exerted a considerable impact on later generations.

These physician–philosophers frequently addressed life phenomena. Their reflections on philosophical issues with biomedical connections are particularly worth investigating because of their professional, and therefore scholarly, concerns. Their intellectual outcomes contributed, albeit in different ways, to the reorientation of philosophy toward questions about nature, which were to become crucial for key figures of seventeenth-century ‘new philosophy.’ The decisive turn of interest toward the natural realm occurred during the sixteenth century, and this reorientation will remain historically inexplicable unless the contributions of physician–philosophers are adequately grasped (Hirai 2011).

Medicine

Although Galenism dominated Western medicine during the Middle Ages, knowledge of the writings of Galen (129–c. 216) was fairly limited. Instead, physicians relied on the
interpretations developed by Arabic writers such as Avicenna (980–1037). The substantial body of Galen’s writings was made available for the first time thanks to the Aldine Greek edition published in Venice (1525). This edition was followed by Latin translations of individual treatises. The ‘newly recovered’ Galen owed much to the medical humanists who were active in the early decades of the sixteenth century. Their efforts introduced the treatise *On the Formation of the Fetus* and other philosophically interesting texts to the intellectual world (Durling 1961; Wear 1981).

Among the issues raised by these texts, the nature of the soul attracted the attention of leading minds. Although Galen frequently addressed the “soul” (*psychê* in Greek, and *anima* in Latin), he refrained from delivering a definitive answer about its nature. This is the famous attitude called agnosticism by modern scholars. Galen sometimes seemed inclined toward a naturalistic interpretation of the soul in some places in his work. This position came close to that of his contemporary, Alexander of Aphrodisias (fl. c. 200): The soul is the ‘mixture’ (*krasis* in Greek, or *temperamentum* in Latin) of the primary qualities (hot, cold, dry, and wet) of the four elements (fire, air, water, and earth). If the soul results from the mixture of these qualities, it must be transient, like all other natural bodies. This would lead to the conclusion that the soul can be destroyed at death. In other places, however, Galen seemed to adopt a position close to the Platonists’ by regarding the soul as something incorporeal and incorruptible. Tension was already present in his writings.

The publication of the Hippocratic corpus in Greek by the Aldine Press dated from 1526, and two Latin translations of the corpus were completed in 1525 and 1546 and were the most circulated versions of the sixteenth century. Initially, many physicians came to Hippocrates through Galen’s commentaries on treatises such as *Aphorisms*, *Prognostic*, and *On Regimen in Acute Diseases*, which were central to university medical education. For a long time, Hippocrates remained, to their eyes, the author of medical precepts and cases, and his theoretically and philosophically interesting writings such as *On Regimen*, *On Fleshes*, and *On Breaths* drew somewhat less attention (Nutton 1989; Siraisi 2009; Hirai 2011).

Alchemy/Chymistry

In tandem with the development of the printing industry, a fervent interest in ‘chymistry’ (alchemy/chemistry) emerged in the sixteenth century. I have adopted the term chymistry to avoid an arbitrary distinction between chemistry and alchemy that did not exist in the sixteenth century (Newman and Principe 1998). Indeed, the period is notable for the fact that leading natural philosophers and physicians took chymical ideas and concepts seriously and incorporated them into their own thinking. The attention to chymistry was further accentuated by the success of the new medicine proposed by the Swiss physician Paracelsus (1493–1541; Pagel 1958; Webster 2008). His major interest was not in gold-making, which was the primary goal of traditional alchemy. He promoted the application of chymical art to medicine. To this end, he borrowed many terms, ideas, and skills from chymistry, especially from a late-medieval current of *alchemia medica* that issued from the work of John of Rupecissa (?–c. 1366) and the writings falsely ascribed to Ramon Lull (c. 1232–c. 1315). On the basis of these, Paracelsus established his own system of natural and medical philosophy.
The impact of Paracelsus’s work on the intellectual map of the sixteenth century began to be felt long after his death, especially around 1570, as the writings of his important followers defending his overall philosophy and cosmology gradually appeared (Thorndike 1941: 617–651; Debus 1977; Kahn 2007).

The Formative and Plastic Power of the Seed

The notion of formative power was one of the major points of discussion by the physician-philosophers of the sixteenth century. Indeed, its Latin form, *virtus formativa*, was frequently used in medieval embryology. Its origin can be traced back to Galen. Establishing the term “molding faculty” (*dunamis diaplastikê*), he argued that this power, which cannot be reduced to the primary qualities of the four elements, was responsible for the highly complex organization of the bodies of living beings (Hirai 2011: 19).

The idea of formative power was transmitted to the West especially by Avicenna’s work. Averroes (1126–1198) also referred to this idea “held by physicians.” Following their discussions, it was adopted by Latin intellectuals. Albertus Magnus (1206–1280) is known for the broader application of formative power, not only to biological issues, but also to physics in general, including the formation of minerals and fossils.

Galen’s Idea Revived

Belonging to the generation of medical humanists active in early sixteenth-century Italy, Nicolò Leoniceno (1428–1524) of Ferrara was prolific in producing widely used translations of Galen’s works. He also composed one of the first humanist embryological treatises, *On Formative Power* (*De virtute formativa*; Venice, 1506). There, he tried to explain Aristotle’s and Galen’s views on formative power with the help of “newly recovered” texts by Galen and Aristotle’s Greek commentators. He gave a new stimulus to the medieval tradition (Nutton 1990: 138–40; Hirai 2011: 19–45).

In his *On the Formation of the Fetus*, Galen acknowledged the presence of supreme intelligence or force in fetal formation, although he confessed to be ignorant of its identity (Galen IV: 700–2). He wondered if it could be identified with a soul, which was believed to reside in the seed. According to him, the Aristotelians called this soul “vegetative,” and the Platonists “appetitive,” whereas the Stoics did not call it “soul” at all but “nature.” For Galen, the seed’s inner soul should be, not merely unintelligent, but also “devoid of reason-principle” (*alagôs*). Although his Platonist master had taught him to regard the World–Soul as the cause of fetal formation, Galen felt it blasphemous to think that the soul of the universe also forms dreadful beasts such as scorpions.

Inspired by these words, Leoniceno argues that Galen opted for the vegetative soul, as he presented this solution as Hippocrates’s idea in his *On Semen* (Galen IV: 542–47). For him, Galen followed Hippocrates in regarding the formative agent of the fetus as a power of the seed’s vegetative soul. But, Galen also stated, in his commentary on Hippocrates’s *Aphorisms*, that the animal’s natural heat forms, nourishes, and augments its body (Galen XVII-B: 420). Despite these divergent views, Leoniceno insists on Galen’s coherence:
Nobody should think that [Galen] disagrees with himself or with Hippocrates. [. . .] For the idea that the soul is nothing but the body's natural heat or constitution, called “temperament,” is also a teaching of Hippocrates. (Leoniceno 1506: f. 2v)

In Leoniceno’s view, Galen defended the concept that what forms the fetus is a certain temperament of the body, that is, a mixture of the four elemental qualities (Ottoson 1984: 129–54; Siraisi 1990: 101–4). To justify this interpretation, he calls upon Galen’s On Tremor. Indeed, in a passage key to understanding of his medical philosophy, Galen called the animal’s natural heat “nature” and “soul.” For him, the animal receives such heat at birth (Galen VII: 616). This is the famous doctrine of “native heat” (calor nativus) or “innate heat” (calor innatus; Hall 1971; Niebyl 1971; McVaugh 1974). Leoniceno concludes that Galen agreed with Hippocrates: The heat given to the seed at the beginning is the soul, which later begets the animal. According to Leoniceno, Galen’s formative power should be understood as a faculty of this vegetative soul, which is, in turn, identified with innate heat or a certain temperament of the bodies of living beings.

The Seed’s Celestial Force

French physician Jean Fernel (1497–1558) was one of the most influential medical authors of the sixteenth century. His teachings exerted a considerable impact on his contemporaries and later generations, until the mid-seventeenth century. Fernel rejected Leoniceno’s naturalistic interpretation of Galen’s idea because, if the soul of living beings is identified as the body’s natural heat or temperament, it depends on the four elements, being transient and, therefore, destructible with the body. In his eyes, this interpretation contradicted the Christian doctrine of the immortality of the soul, a doctrine that became a major theme in philosophy, especially after the Fifth Lateran Council (1512–1517). Calling upon Renaissance Platonism developed by Marsilio Ficino (1433–1499) in the late fifteenth century, Fernel tried to present another image of Galen that could resonate with Christianity. The chief fruit of his endeavor was the dialogue On the Hidden Causes of Things (De abditis rerum causis; Paris, 1548). There, he advocated the quest for the ‘divine’ (to theion) in nature and in medicine. By the term ‘divine,’ he signified something super-elemental and celestial, that is, something lying beyond the order of the four elements and their forces (Hirai 2005: 83–103; Hirai 2011: 46–79).

Using Galen’s own words, Fernel first seeks to establish agreement between Galen and other ancients, such as Plato and Aristotle, as well as the Christians, on the immortality of the soul. To this end, he tries to show the ‘celestial’ origin and nature of the soul, not only for human beings, but also for other animals. Then, Fernel addresses a common belief about the nature of its three parts (vegetative, sensitive, and rational): Only the supreme one (rational) is divine and immortal, whereas the other two (vegetative and sensitive) parts are perishable, even if these three form one and the same soul (Fernel 2005: 466). Despite this widespread view, Fernel insists that the inferior parts of the soul also have a share in divinity. To prove this, he quotes several passages from Galen’s On the Formation of the Fetus, one of which states:

For even when I hear some philosophers speaking of matter which possesses a soul from eternity and embellishes itself perfectly with its gaze fixed on Ideas, I think
much rather that there should be one soul that both shaped us in the past and makes use of our individual parts in the present.

(Galen IV: 696–97)

The passage identifies the soul forming the body with the soul governing the body. For Fernel, Galen’s words hint at the relationship between the soul and the agent that forms living beings.

In Fernel’s view, Galen offered the clearest explanation of this agent among the ancient Greeks. Indeed, in his *On the Usefulness of the Parts of the Body*, Galen referred to a certain mind of the universe that builds the body parts of living beings in accordance with each part’s end (Galen IV: 358–60; Fernel 2005: 430–32). Identifying this cosmic mind with the World–Soul, Fernel considers it the source of a certain divine “force” (*vis*), which embraces all the parts of living beings. Whatever label is used, be it ‘nature,’ ‘soul,’ or ‘force,’ what governs the functions of body parts must be divine if the formative agent of these parts is divine. For Fernel, the seed’s formative force results from the heavenly realm, that is, from the cosmic mind of Galen and the World–Soul of the Platonists. That is why this force is qualified as celestial and divine, exceeding the order of the four elements and their forces.

**The Plastic Faculty as God’s Invisible Hand**

An accomplished humanist and a moderate Lutheran, Jacob Degen, alias Schegk (1511–1587), taught philosophy, and later medicine, at the University of Tübingen. His lectures attracted many students from Reformed lands (Kusukawa 1999; Hirai 2011: 80–103). Keenly interested in medical and biological issues, he composed an embryological treatise *On the Plastic Faculty of the Seed* (*De plastica seminis facultate*; Strasburg, 1580), among other writings.

In this treatise, Schegk advances that the “formative and plastic faculty” (*facultas formatrix et plastica*) is the most remarkable among the forces of natural things. This faculty fashions, from the formless matter of seeds, an animate body with parts that are well formed in terms of quality, figure, number, position, and so on. Continuously generating perishable things through this faculty, God skillfully preserves the perpetuity of all sublunary species.

To further explain the plastic faculty, Schegk posits two kinds of efficient cause. One is “irrational and material.” Elemental qualities, which “change” something, belong to this group. By contrast, the other category comprises forms and reason–principles that “generate” something (Schegk 1580: sig. A1v). The plastic faculty belongs to the second group and is qualified as the efficient cause of the generation of living beings.

Schegk classifies the efficient cause again into two kinds (principal and instrumental). Under this scheme, the plastic faculty is defined as an instrumental cause. Its principal cause is either the male parent emitting the seed or heaven remotely governing the generation of all living beings. Schegk also explains the instrumental character of the plastic faculty by calling it “productive potentiality” (*dunamis poiētikê*). As an instrumental cause, subordinated to the principal agent, this faculty is conceived as a kind of *dunamis*, that is, power or potentiality, different both from something in actuality and from matter, purely passive and inert.

Referring to the term “devoid of reason–principle” (*alogos*) that Galen adopted to describe the seed’s inner soul in his *On the Formation of the Fetus*, Schegk reproaches Galen
for his error in attributing “irrationality” to natural and enmattered forms. He believes that there must be nonintellectual, yet rational, principles in nature. Thanks to these principles, nature is organized in a structured order as a rational reality. In Schegk's view, such natural reason–principles do not need to be associated with intelligence, even though, like nature, they do nothing in vain. This idea of nature, endowed with reason–principle but devoid of intelligence, was to be inherited by Cambridge Platonists such as Henry More (1614–1687) and Ralph Cudworth (1617–1688; Hirai 2011: 87).

As for nature, Schegk contrasts it with art. He argues that works of nature are different from works of art, as art’s reason–principles are “external” efficient causes, whereas nature’s reason–principles are “internal” efficient causes. The internal principles of nature for the generation of natural beings were created by God and reside in these beings. They produce their works for the sake of definite ends because, created by God, they imitate the Creator as if they were the invisible hands and instruments of this wisest Artificer (Schegk 1580: A6r–v).

Schegk’s plastic faculty does not establish a hylomorphic composite with matter as form, although it is seen as a kind of natural reason–principle or substantial form in sublunary things. It should be construed as a certain “actuality” (energeia) or “movement” (kinēsis) to execute its action. From here on, this faculty is described in terms of actuality, that is to say, the plastic faculty at work. To this end, Schegk introduces a notion of “second actuality” (actus secundus). Even though the artist cannot reside in his instrument, movement and actuality derived from him can. This state of actuality in the instrument is the second actuality. The seed does not, Schegk argues, contain the corporeal parts of a future animal, but only its “productive actuality” (energeia poiētikê). By this special actuality, an animate being can generate another animate being of the same species through the seed. For Schegk, the plastic faculty is productive and is construed as the second actuality that resides in the seed. He concludes that the plastic faculty is something intermediate between what is animate and what is to be animated (Schegk 1580: sig. B2r).

Schegk’s theory of the plastic faculty can be understood better in the context of the debate between Leoniceno and Fernel. Leoniceno interpreted formative power, ascribed to the seed by Galen, as a product of the elemental qualities, that is, their mixture or temperament. By contrast, Fernel placed the origin of the seed’s formative force beyond the order of the four elements: It emanates from heaven or from the World–Soul. Leoniceno’s formative power is transient and perishable, whereas Fernel’s formative force is celestial and divine. Schegk, in his turn, considered his plastic faculty to be a power created by God as His invisible hand, that is, something intermediate lying between actuality and potentiality.

**Toward Plastic Nature**

In his *Physical Memories* (Hypomnemata physica; Frankfurt, 1636), Daniel Sennert (1572–1637) of Wittenberg made a critical assessment of the ideas advanced by his forerunners. His treatise encompasses the cluster of issues raised in the intersection of matter theories and the life sciences of his time (Hirai 2011: 151–72). On the generation of living beings, he first addresses Avicenna’s theory, according to which forms come from a superior cosmic intelligence called the “Giver of Forms” (dator formarum). For Sennert, although the astral causality promoted by this kind of idea is widely diffused, it should be taken only as a remote
cause. He also rejects Fernel’s theory by arguing that it is unnecessary to draw souls out of the heavenly realm because, at the Creation, God granted to living beings their own capacity to multiply. Next, Sennert addresses Schegk’s theory:

Indeed, to hold a plastic reason–principle, which is not the soul, is to multiply [useless] things without reflection. Since all the properties and operations of the soul are found in and attributed to this plastic reason–principle, why should it not be called the “soul”? Since the soul in the seed is sufficient for all the actions attributed to this plastic reason–principle, why should one hold any other [entity] than the soul?

(Sennert 1636: 178)

For Sennert, the plastic reason–principle in the seed is nothing but the soul, which is not the instrument but the principal agent of generation. It is absurd, he argues, to think that formative power produces such a noble and divine substance as the soul. This power cannot be the “faculty of the seed having no soul,” but the “faculty of the soul residing in the seed.” That is why he rejects Schegk’s idea that the seed’s formative power produces the soul.

Paradoxically, Sennert’s criticism accelerated the wide diffusion of Schegk’s theory among seventeenth-century physicians (Hunter 1950). William Harvey (1578–1678), for instance, drew on this theory for establishing the idea of “plastic force” (vis plastica) in his epigenetic system. The notion of plastic power further came to play an important role, not only in embryology, but also in broader natural philosophy, as is observed in Athanasius Kircher (1602–1680; Hirai 2007). More and Cudworth transformed the idea into their own famous doctrine of “plastic nature.” Aimed at explaining the organizing agent of the created world as a whole rather than the mere formation of living beings, this doctrine held significant metaphysical and theological implications, as is seen in the interest manifested by Gottfried Wilhelm Leibniz (1646–1716; Smith 2007). A medical theory of the sixteenth century thus culminated in one of the most debated philosophical themes in the era of the Scientific Revolution.

**Spirits, Cosmic Heat, and the Principle of Life**

As shown above, the idea of the soul was generally used from antiquity through the sixteenth century to explain the cause of life phenomena in natural philosophy and medicine (Park 1988; Wright and Potter 2000; Bakker 2012). The soul was construed as the principle of life in the bodies of living beings, and the ‘spirit’ (pneuma in Greek, and spiritus in Latin) was often defined as its corporeal instrument for physiological functions (Peck 1953; Bono 1984). In the sixteenth century, the idea of the ‘vital principle’ (principium vitale) gradually upstaged the role of the soul at the intersection of natural philosophy, medicine, and chymistry. A century-long quest for its material carrier was launched. The present section aims to describe some major moments in this move.

Let us begin with the mysterious words of Aristotle in his Generation of Animals. This was one of the most frequently commented passages in his biological works during the Middle Ages and sixteenth century. It was meant to address the invisible components of the seeds of living beings:
In every seed there is that which makes it fertile, that is, what is called “heat.” This heat is neither fire nor any such faculty but the *pneuma* which is contained in the seed and its foam-like body. Nature in this *pneuma* is analogous to the element of the stars. That is why fire does not generate any animal, and we find no animal taking shape in either fluids or solids under the influence of fire; whereas the heat of the sun and that of animals do generate them. Not only the heat residing in the seed but also whatever other natural residue, which there may be, also has in itself a vital principle.

(Aristotle, *Generation of Animals* 2.3, 736b33–737a7)

The seed encloses the *pneuma*, heat and nature, as its invisible components. “Nature” in the seed’s *pneuma* is said to correspond by analogy to the element of the heavenly bodies, that is, the incorruptible, eternal, celestial matter, called aether by Aristotle. Thus, a cosmological dimension is introduced in the middle of his embryological discussion. The passage contains another important element as it refers to a “vital principle” (*archê zôtikê*) enclosed in the heat of living beings. This special principle can be taken to hold the secret of the origin of life (Solmsen 1957; Preus 1970: 35–38; Balme 1972: 161–64; Freudenthal 1995: 107–19).

The interpretative potential of this cosmological passage in Aristotle does not seem to have attracted particular attention from his Greek commentators. Arabic writers such as Avicenna and Averroes, by contrast, explored it to explain Galen’s idea of formative power. They also introduced the notion of ‘intellect’ (*aql* in Arabic, or *intellectus* in Latin) in their discussions. The link between the seed’s plastic power and the principle of intellectual activity might surprise us, but it was totally natural for them, as Aristotle referred to the intellect in two places, right before and after the cosmological passage. One quote reads: “It remains, then, that the intellect alone comes from the outside and that it alone is divine; for the bodily actuality has nothing to do with its actuality” (36b27–29). The other says:

But the body of the semen, in which there also comes the portion of the principle of the soul—partly separable from body in all those in which something divine is included (and such is what we call the intellect) and partly inseparable.

(737a7–12)

These two loci were often used to confirm the incorporeal and indestructible character of the intellect that was believed to be shared only by human beings among living beings, according to the Aristotelian tradition. From this perspective, Latin authors such as Albertus Magnus and Thomas Aquinas (c. 1225–1274) developed their philosophical and theological interpretations. Aristotle’s cosmological passage also offered a theoretical foundation for medico-astrological speculations on human conception or nativity, as seen in Pietro d’Abano (1257–c. 1315).

**Spirits and Their Celestial Origin**

In the sixteenth century, Fernel gave a new pulse to these traditions. He repeatedly called upon Aristotle’s cosmological passage in the embryological and physiological discussions...
of his On the Hidden Causes of Things. There, Fernel developed his own theory of spirits by dividing them into three categories: (1.) the spirit of God, (2.) the spirit of nature, and (3.) the spirits in living beings (Fernel 2005: 478–80; Hirai 2011: 67–72). The spirit of God is that of the Bible. The spirit of nature is inspired by Ficino’s theory of the all-pervading “World-Spirit” (spiritus mundi) as the medium between the World–Soul and its body (machīna mundi). As for the inferior kind of spirit in living beings, Fernel seems to respect the traditional theory: The spirit is subject to the soul as its instrument and ties the soul to the body of living beings, while remaining the mediator between the two. But, he adds a new dimension: The inferior spirit is governed by and tied to the superior spirit of nature, which is, in turn, directed by the spirit of God. In this elaboration, Fernel explicitly relies on Aristotle’s cosmological passage by arguing that the spirit and its heat are celestial and divine. Indeed, living beings, at death, must lose the principle of life’s functions. According to Fernel, death occurs when the heat of the spirit is extinguished. Thus, the heat of the spirit bears a super-elemental nature as the principle of life. Fernel goes even further, to compare it to the light and heat of the sun, in a Platonic perspective. Needless to say, the sun was understood as a visual representation of the World–Soul by Ficino and his followers (Hirai 2002: 273).

To explain what he means by the term “divine,” Fernel calls upon Aristotle’s words by defining it as “anything that corresponds to the element of the stars” (Fernel 2005: 494). This special element is the indestructible aether of Aristotle. Being the source of the inferior spirits in living beings, it lies beyond the order of the four elements. Therefore, there is no way for the human being in the sublunary world to seize the spirit in a material dimension. The crucial instrument of Fernel’s physiology was thus built on the Platonizing reading of Aristotle’s cosmological passage, which becomes a symbol of sixteenth-century astral medicine (Hirai 2014).

**Cosmic Heat and the World–Soul**

Another passage in Aristotle’s Generation of Animals was often invoked in connection with the cosmological passage. It explained the cause of spontaneous generation: “There is water in earth, and pneuma in water, and in all pneuma is soul–heat, so that all things are in a sense full of soul” (Aristotle, Generation of Animals 3.11, 762a18–21). What is important here is the idea of “soul–heat” (thermotês psychikê) carried by the pneuma present everywhere in the world.

Girolamo Cardano (1501–1576) of Milan notably explored this linkage. Expounding a pan-vitalistic worldview in his extremely successful work On Subtlety (Nuremberg, 1550), he formulated a theory of “cosmic heat” by which he defended the omnipresence of souls in the universe (Hirai 2005: 135–56; Hirai 2011: 110–14). According to Cardano, cosmic heat, or heat coming from heaven and diffused everywhere in the world, is the source of all kinds of sublunary heat. This heat is the active principle in the generation of animals, plants, and minerals. Cardano goes even further by identifying cosmic heat with the soul of the universe or its instrument:

> it is evident that Hippocrates correctly said: the soul is nothing but that celestial heat. This also corresponds well to the opinion of Aristotle since he wants the
heat of the spirit to have an analogy with the element of the stars. Indeed whether the heat is the soul or its first instrument, wherever there is this [kind of] heat, it is evident that the soul itself should also be present; therefore [there should be] life too. For life is nothing but the work of the soul.

(Cardano 1550: 325–26)

Here, Cardano also advances the cosmic dimension of the soul by relying on the treatise On Flesches ascribed to Hippocrates. In his Physicians’ Contradictions, he even tries to show that cosmic heat is animated and endowed with intelligence (Hirai 2011: 112–13). The use of this Hippocratic treatise in the Platonizing reading of Aristotle’s cosmological passage became popular after Cardano, in the late sixteenth century.

The Spirit as a Material Crystallization of Cosmic Heat

Another interesting case can be observed in Italian natural philosopher Bernardino Telesio (1509–1588). In his major work On the Nature of Things According to the Appropriate Principles (Naples, 1586), or its early version On Nature (Rome, 1565), most probably following the footsteps of Cardano, Telesio reduced the number of the elements from four to two: heat and cold. Heat is the active principle of all natural things and is represented by heaven or the Sun, whereas cold is the passive principle symbolized by the Earth. At a crucial moment in the justification of his theory, Telesio argues that Aristotle recognized something derived from heaven as the single cause of all natural beings. He identifies it with cosmic heat on the basis of Aristotle’s cosmological passage (Telesio I: 348–50; Hirai 2012).

After the principles of all natural things, Telesio turns to those of living beings. He rejects the view of the soul as the cause of their generation. As Alexander of Aphrodisias and other Aristotelians acknowledged heat and cold as the forms of the four elements, he believed that these primary qualities should also be taken as the forms of all other beings. Telesio argues that cosmic heat, as the supreme principle of the universe, does not need to be directed by another higher substance, because it executes its action after its own “nature” (ingenium). Aristotle himself, adds Telesio, taught that heat and the spirit constitute both the bodies and the souls of all natural things. To prove this, he quotes Aristotle’s words on spontaneous generation from his Generation of Animals and returns once again to the cosmological passage of the same treatise (Telesio I: 354).

As we have seen, Cardano tried to defend the omnipresence of souls, ensured by cosmic heat, on the basis of Aristotle’s words. In doing so, he called upon the notion of “soul–heat.” For him, as for Aristotle, this heat explained the cause of spontaneous generation and held a key to understanding the origin of life phenomena as the principle of life. Although Telesio uses the same passages as Cardano for a similar purpose, he shifts his emphasis from the soul itself to cosmic heat and, further, to the spirit. Indeed, for Telesio, the spirit plays the role of the soul in the bodies of living beings. What is most significant in his system is that the spirit is seen as an active material portion in which cosmic heat is highly condensed (Hirai 2012: 79). In this perspective, the spirit is, so to speak, the vehicle of cosmic heat or its material representation.
In his masterpiece *The Idea of Philosophical Medicine* (*Idea medicinae philosophicae*; Basel, 1571), the Danish Paracelsian Petrus Severinus (1540/1542–1602) introduced a chymical dimension to this series of interpretations of Aristotle’s words (Shackelford 2005; Hirai 2005: 217–65). According to Severinus, certain natural things exhibit surprising effects exceeding the capacity of the four elements and their properties. The cause should be sought in their “internal element” (*elementum internum*), which he also calls “balsam” (*balsamus*) or vital balsam, whereas the traditional four elements are merely its external vestments. As a key to grasping this special element, Severinus appeals to Aristotle’s cosmological passage. There, he argues that Aristotle and Theophrastus learned the limit of the four elements in their study of the generation of living beings. That is why Theophrastus introduced the idea of the “vital principle of nature” (*principium vitale naturae*) in his work *On the Causes of Plants*, and Aristotle, in that cosmological passage, referred to a certain “divine body” that lies beyond the order of the four elements (Severinus 1571: 18). Thus, for Severinus, vital balsam, as the internal element and the radical matter, is the real identity of the vital principle. He also calls the Platonists and Hippocrates into this theater of the harmonization of the ancients on the basis of the belief in the “ancient theology” (*prisca theologia*), reactivated by Ficino and developed during the sixteenth century (Schmitt 1966; Walker 1972; Schmidt-Biggemann 2004).

Severinus is not satisfied with establishing the agreement of the ancients on the internal element of life. By calling it the “fifth element,” he then turns to the followers of the mythical Hermes Trismegistus, that is, the chymical philosophers. This is his goal:

More secret philosophers, following Hermes, learned to separate the impure from the pure. Observing the corruptible and filthy nature of the external elements, they called this very pure and crystalline material “fifth element,” “essence,” “balsam,” “accomplished material” and many other names of this sort.

(Severinus 1571: 20)

Severinus is especially interested in the chymists’ idea of the “separation of the pure from the impure” (*separatio puri ab impuro*). Indeed, this axiom was celebrated by Paracelsus (1493–1541), whom Severinus praises as the “glory of Germany” (*decus Germaniae*; Severinus 1571: 17). More importantly, he teaches that chymists can extract vital balsam from animals, plants, and minerals in the form of a “pure crystalline material.” He most probably meant salt-like substances by this term.

Severinus goes even further to insist that his vital balsam provides the foundation of the “universal medicine,” able to cure all kinds of disease. This medicine can be obtained only by the chymical art of separation. Severinus thus establishes the harmonization of divergent ideas held by the ancients and his immediate forerunners, including Paracelsus and Fernel. Multiple names do not stop him concentrating on one divine material that holds the secret of life phenomena. For him, this internal element of life lies hidden in the bosom of the bodies of animals, plants, and minerals. This is the vital principle of nature, celebrated by Theophrastus as the source of all functions of life. What is important here is that Severinus clearly conceives of it as a material substance that could be manipulated by chymical philosophers.
On the basis of Aristotle's enigmatic cosmological passage in the embryological discussion, Fernel developed his own theory of the spirit. For him, the soul remained the principle of life, and the spirit was its carrier and instrument. In Fernel, there was no move to capture them in a material dimension. Using the same words of Aristotle, Cardano established his theory of a cosmic heat identified with the soul of the universe. Like Fernel, he showed no interest in the quest for it as a physical entity. Telesio extended Cardano's theory to regard the spirit as a material condensation of cosmic heat. In his system, the soul was no longer the required principle of life's functions. Severinus, in his turn, further suggested the possibility of capturing the vital principle in the form of a material spirit, vital balsam. This special entity provided the foundation for his universal medicine. Indeed, he wanted to link a theme amply discussed by his forerunners (i.e., Aristotle's cosmological passage) with Paracelsus's teachings, in order to render them acceptable and respectable for the intellectuals of the time.

Later, in the early seventeenth century, followers such as French Paracelsian Joseph Du Chesne, alias Quercetanus (1546–1609), were eager to seek the material spirit of life with a view to achieving their dream of the universal medicine (Hirai 2005: 267–94; Hirai 2010). Needless to say, medicine and chymistry were inseparably connected in their quest.

Seeds and the Seminal Principle

In early modern chymistry or the biological and medical sciences, ideas derived from ‘seeds’ (semina) can frequently be observed: ‘seeds of things’ (semina rerum), ‘seeds of reasons’ (semina rationum), ‘seminal reasons’ (rationes seminales), ‘seminary’ (seminarium), and ‘seminal principle’ (principium seminale). For the sake of discussion, let us group these notions together under the provisional name of ‘concept of seeds.’ This concept was often used to explain the formation and organization of natural bodies, and even the origin of forms in them. It first took shape in the cosmological metaphysics of Ficino, and was then systematized by figures such as Fernel, Paracelsus, and Severinus during the sixteenth century. It was finally reinterpreted in a corpuscular perspective, culminating in the notion of ‘molecule’ (molecula) as the seeds of things (semina rerum) in French atomist Pierre Gassendi (1592–1655). The concept of seeds can be seen as a missing link that bridged between the medieval scholastic doctrine of substantial forms and the mechanistic corpuscular theories of the late seventeenth and eighteenth centuries (Hirai 2005).

Ubiquity of Invisible Seeds in Nature

In his philosophical works, Ficino adopted various terms derived from the seed so as to designate the formative cause in the sensible world: “seeds of reasons” (semina rationum), “seminal reasons” (rationes seminales), “seminary” (seminarium), and “seminary reason of the world” (ratio seminaria mundi; Hirai 2002).

Following Neoplatonists such as Plotinus and Proclus, Ficino elaborated the theory of hypostatic substances in his interpretation of Plato's works (Allen 1982). According to the version developed in his Commentary on Plato’s Symposium (written before 1482), in the concentric metaphysical universe, the divine mind derives from the Good, which is the preeminent being of God. It is followed by the soul of the universe, then nature, and...
finally matter. Nature is an intermediate hierarchy between the soul and matter. Ficino attributes 'divine species' (species divinae) to each of these hypostases: 'ideas' (ideae) to the mind; 'reasons' (rationes) to the soul; 'seeds' (semina) to nature; and 'forms' (formae) to matter. Ideas turn around God and connect Him with the mind. Reasons gravitate around the mind and connect it with the World–Soul. Seeds revolve around the soul and link it to nature. Finally, forms turn around nature and form the bridge between nature and matter (Ficino 1956: 149–151). Forms are the ultimate vestiges of the divine species, all of which are incorporeal and spiritual. Thus, seeds share the same source with superior species (ideas and reasons) and inferior species (forms). Beauty, regarded as the ray emanating from God, embellishes the mind with ideas, fills the soul with reasons, impregnates nature with seeds, and dresses matter with forms.

Ficino further identifies nature with the 'power of generation' (potentia generandi). He also qualifies as 'seminary' or 'seedbed' (seminarium) the vivifying power that is diffused in the whole world. Comparing the emanation of these hypostases with the Sun's rays, Ficino sees nature's correspondence to 'heat' (calor), which is responsible for the generation of bodies. Generation is linked to a biological notion of fertility. This fecundity is introduced into nature through the invisible ray of the World–Soul, which conveys the spiritual seeds. Ficino thus incorporates the concept of seeds as an integral part of his metaphysical universe. For him, these invisible and spiritual seeds are the drafts of forms, introduced in formless matter so as to generate diverse beings in the sensible world.

In his masterpiece Platonic Theology (Florence, 1482), Ficino goes even further by combining the Thomistic doctrine of substantial forms with his concept of seeds. According to him, nature encloses the invisible seeds, which have the power to extract the substantial forms of the elements from the depth of matter. These seeds are superior to the elemental forms and, under their direction, the elemental qualities bring about properties such as colors in natural things. Ficino's seeds are therefore able to make Aristotelian physics subordinate to Platonic metaphysics (Hirai 2002: 269; Hirai 2011: 142–43).

The Christianization of the Concept of Seeds

Fernel was the first academic to introduce Ficino's teachings into the foundation of his learned medicine. Calling upon the præsca theologia belief, he established the basis of his natural and medical philosophy by the harmonization of ancients such as Plato and Aristotle. In doing so, he adopted Ficino's concept of seeds. According to Fernel, the seeds of the forms of natural things were sown by God at the moment of the Creation of the world. Now, these seeds fall from heaven, being carried by the World–Spirit diffused everywhere in the universe. Fernel connected the Ficinian theory of the universal spirit with the Biblical idea of the spirit (breath) from God's mouth, as is seen in Psalm 32 (33):6 (Fernel 2005: 342–44). Fernel thus tried to place his concept of seeds in a Christian perspective.

Parallel to Fernel, Paracelsus also contributed much to the elaboration of the concept of seeds (Hirai 2005: 179–216). Although he might initially have been inspired by Ficino's idea, he radically Christianized its contents. In his system, it is God who sowed the archetypal Word 'Fiat' as the primordial seed of the universe in the Creation of the world. This divine seed enclosed within itself the seeds of the four elements (Paracelsus XIII: 9, 12–13). Paracelsus did not see the four elements as the material causes of natural bodies, but as their cosmological
receptacles, called ‘mothers’ (müter). These matrices contain all natural beings in the form of particular seeds and foster them until their maturation as ‘fruits’ (früchte; Paracelsus III: 32–33). Thus, all creatures are born from their own spiritual seeds. Each being in nature lives its biological time and grows toward its definite end, according to the ‘predestination’ (praedestinatio) that was determined by God. At the time of harvest, natural things are consumed by human beings as food or medicine (Paracelsus III: 34–35).

In Paracelsus, universal nature is depicted as the divine Sower’s enormous bag, which contains the spiritual seeds of all natural beings mixed together. Each seed encloses the three principles (salt, sulfur, and mercury). These are not the natural substances bearing these names but the symbolical denominations based on their functions. They should not be understood as the material causes from an Aristotelian perspective. These three principles in the spiritual seed determine the development (life) of each individual through the intervention of administrator ‘workers,’ conceived in the guise of internal alchemists. Paracelsus referred to them as “vulcanus” when they are in nature and as “archeus” when inside the human body (Paracelsus III: 35 and XI: 187–88).

A Synthesis as the Philosophy of Seeds

Under the influence of Ficino, Fernel, and Paracelsus, Severinus established his unique system, which can be qualified as the ‘philosophy of seeds.’ Indeed, the concept of seeds occupies the central place of his natural and medical philosophy (Hirai 2005: 217–65). In his masterpiece, Severinus built a synthesis upon the prisca theologia belief so as to defend the teachings of Paracelsus. Among his immediate forerunners, besides Paracelsus, he owed much to Fernel, despite his efforts to eclipse the Frenchman’s fame with that of Paracelsus.

Severinus’s theory of the four elements largely depends on that of Paracelsus. They are not conceived as the material causes of natural bodies, but as the cosmological receptacles of all creatures. According to Severinus, God implanted future fruits in the form of invisible, spiritual seeds in these matrices (Severinus 1571: 41–42). The elements foster the spiritual seeds in their bosom so as to produce their fruits and nourish them. This process is programmed according to a determined delay for each individual (Severinus 1571: 45–47). The spiritual seeds thus assure the presence of life’s vestige everywhere in the world and guarantee the continuity of natural species. They are the source of all kinds of action in nature, as they provide all the properties of sensible things. In Severinus’s favorite expression, everything in nature is regulated by the seeds’ tide-like ebb and flow (Severinus 1571: 89).

Severinus places the ‘principles of the bodies’ (principia corporum) in the spiritual seeds. Identified with Paracelsus’s salt, sulfur, and mercury, these principles are subject to the incorporeal components of the seeds, called reasons (rationes), knowledge (scientia), and gifts (dona). It is these components that regulate the flows of the seeds (Severinus 1571: 63). The spiritual seeds also need the instrumental agents to produce corporeal bodies in the process of generation. Severinus calls these internal agents the mechanical spirits (spiritus mechanicī), the spiritual workers or craftsmen conceived upon the model of Paracelsus’s archeus. Residing in the seeds, they produce individuals with the help of the scientia given to the seeds. According to Severinus, spirits deprived of scientia are merely sterile vapors, whereas the mechanical spirits endowed with scientia are fertile and productive. If they have the scientia of the heart, they construct the heart; if they possess the scientia of the brain, they build the brain (Severinus 1571: 107).
These are the main features of Severinus’s teachings. His work was venerated by many physician–philosophers of the turn of the century and exerted a considerable impact on the matter theories of the following generations. His fervent followers included Du Chesne, Oswald Croll (c. 1560–1608), and Johann Baptiste Van Helmont (1579–1644). Under the influence of Du Chesne, especially, the concept of seeds became widespread in the early seventeenth century to explain the generation of living beings (animals and plants), as well as the formation of nonliving natural things (stones, minerals, and metals). Prominent philosophers such as Francis Bacon (1561–1626) also came to know this concept, developed in the tradition of sixteenth-century chymical philosophy. Although Sennert, in turn, preferred forms and souls to spiritual seeds, Severinus’s ideas led him to develop the notion of the seminal principle (principium seminale), to which the young Robert Boyle (1627–1691), and many others, were to pay considerable attention in the late seventeenth century (Clericuzio 1990: 583–87; Anstey 2002; Hirai and Yoshimoto 2005).

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