CHAPTER 7

Kircher's Chymical Interpretation of the Creation and Spontaneous Generation

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INTRODUCTION

No one would call into question the fact that Athanasius Kircher (1602–80) won fame through the intellectual activities he pursued over decades at the heart of the Jesuit institution, the *Collegio Romano*.[1] To reinforce his arguments, he constantly had recourse to experiments and observations that he claimed to have made himself or had reported to him by others. His work was simultaneously an object of admiration and of suspicion by his contemporaries, and it provoked numerous debates all over Europe. Among these debates, the problem of spontaneous generation drew particular attention from scholars who tried to reproduce Kircher's experiments in order either to verify or to refute their veracity. Thus, in England, several important figures of the Royal Society such as Robert Boyle (1627–91) and Henry Oldenburg (1615?–77) investigated this problem through the 1650s and 1660s, while in Italy, Francesco Redi (1626–97) publicly critiqued the Jesuit father in his famous work *Experiments on the Generation of Insects* (Florence, 1668).[2] In

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[1]On Kircher, see (among others) *Dictionary of Scientific Biography* (hereinafter *DSB*), 7 (1973), pp. 374–378; P. Conor Reilly, *Athanasius Kircher SJ: Master of a Hundred Arts, 1602–1680* (Wiesbaden: Edizioni del Mondo, 1974); Thomas Leinkauf, *Mundus combinatus: Studien zur Structur der barocken Universalwissenschaft am Beispiel Athanasius Kirchers S.J. (1602–1680)* (Berlin: Akademie, 1993); Paula Findlen (ed.), *Athanasius Kircher: The Last Man Who Knew Everything* (London: Routledge, 2004).

[2]See Hiro Hirai, "Quelques remarques sur les sources de Robert Boyle en guise de compte rendu de la nouvelle édition de son œuvre," *Archives internationales d'histoire des sciences*, 53 (2003): 303–318, esp. 313. On Redi, see *DSB*, 11 (1975), pp. 341–343; Walter Bernardi and Luigi Guerrini (eds.), *Francesco Redi: un protagonista della scienza moderna* (Florence: Olschki, 1999).

general, historians have considered these reactions as noteworthy manifestations of the new experimental science. But very few have seriously examined what Kircher really taught and what stimulated the scientific programs of his adversaries who based themselves on more rigorous methods of experiment and observation.

For Kircher, the problem of spontaneous generation, or more precisely, that of the origin of life, was closely connected to such important and difficult questions for his contemporaries as the Creation of the world, the generation of contagious diseases, the formation of fossils, and the origin of figures and colors in natural things like gems, plants and animals. Indeed, Kircher discusses these points to various degrees on many occasions in his writings. However, one of the best elaborated developments can be found in the last book of his geocosmic encyclopedia, *Mundus subterraneus* (Amsterdam, 1664–65).[3] The aim of the present paper is to analyze, through the careful reading of this text, Kircher's ideas on spontaneous generation and to put them back into their due historical and intellectual context. For this purpose, we shall first examine Kircher's "concept of seeds" that furnishes the very foundation of his system for the generation of natural things in general, and then his theory of spontaneous generation.[4]

Creation, Chaotic Matter and Panspermia

From the beginning, Kircher's discussion on the origin of life is explicitly connected to his interpretation of the Creation story in Genesis.[5] According to Kircher, God wanted the visible machine of this world to persist without interruption until its end. Lest the world should perish in the succession of time by the defects of species, God made generation and corruption succeed one after another thanks to a nature given to each species. Kircher affirms that

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[3]See Lynn Thorndike, *A History of Magic and Experimental Science* (New York: Columbia University Press, 1958), Vol. 7, pp. 567–578; Gerhard F. Strasser, "Science and Pseudoscience: Athanasius Kircher's *Mundus Subterraneus* and his *Scrutinium . . . Pestis*," in *Knowledge, Science, and Literature in Early Modern Germany*, eds. Gerhild S. Williams and Stephan K. Schindler (Chapel Hill: North Carolina University Press, 1996), pp. 219–240; Nicoletta Morello, "Nel corpo della Terra: il geocosmo di Athanasius Kircher," in *Athanasius Kircher: il museo del mondo*, ed. Eugenio Lo Sardo (Rome: Edizioni de Luca, 2001), pp. 179–196.

[4]I have used Athanasius Kircher, *Mundus subterraneus*, 2 vols. (Amsterdam, 1664–1665), hereafter indicated as *MS*, XII.5.4, 331 = book XII, section 5, chapter 4, page 331. On the Renaissance concept of seeds, see Hiro Hirai, *Le concept de semence dans les théories de la matière à la Renaissance: de Marsile Ficin à Pierre Gassendi* (Turnhout: Brepols, 2005).

[5]On the early modern chemical interpretation of Genesis, see Michael T. Walton, "Genesis and Chemistry in the Sixteenth Century," in *Reading the Book of Nature: The Other Side of the Scientific Revolution*, eds. Allen G. Debus and Michael T. Walton (Kirksville: Sixteenth Century Journal Publishing, 1998), pp. 1–14; Hirai, *Le concept de semence*, pp. 201–6, 446–50.

this nature is nothing but "the seminal and spermatic force" (*vis seminalis et spermatica*) by which living beings overcome their destruction through natural propagation. For Kircher, the omnipresence of this force in the visible world is the clear sign of the power and wisdom of God. He adds that philosophers, having searched after the origin of this force for a long time, found only the remote sources of its hidden essence. He explains then what the immediate sources of this force are:

> It is thus clear from the holy Mosaic oracles . . . that in the beginning, God, the founder of all things, created from nothing a certain matter that we rightly call "chaotic." For the glorious God created everything at the same time. In this [matter] is hidden, just as if mingled under a certain "panspermia," everything that is to be produced in the nature of mixed bodies and material substances. Since the divine Architect created nothing *de novo* except this matter and the human soul, it is evident from the very text of the holy page that God then drew forth from this single chaotic matter, as from matter subject to and already made fertile by the incubation of the divine spirit, all things, both the heavens and the elements, and from these latter drew forth, by the power of His almighty voice alone, the species of both plants and animals (except the rational soul). . . . All beings could then propagate themselves thanks to a seminal power given to them in everlasting generation.[6]

For Kircher, God did not immediately create natural things, but produced them by way of this chaotic matter, which was first drawn from nothing and into which God inserted at the same time the *panspermia*, the universal seed of Nature.[7] Kircher identifies this primordial seed with a *spiritus* which plays the role of the medium between the Creator and creatures. For him, the holy text of Genesis testifies that God inserted this seminal *spiritus* into the chaotic matter for the propagation of living beings. But, what is the real nature of this *spiritus*? Kircher says:

> I say that a certain material *spiritus* was composed from the subtlest [part] of the celestial breath or from the portion of the elements and that a certain spirituous salino-sulfuro-mercurial vapor, a universal seed of things, was created along with the elements by God as the origin of all things, which were established in the world of corporeal entities.[8]

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[6]*MS*, XII.1.1, 327.

[7]On Kircher's *panspermia*, see Joseph Gutmann, *Athanasius Kircher (1602–1680) und das Schöpfungs- und Entwicklungsproblem* (Fulda: Parzeller, 1938), pp. 19–21; Leinkauf, *Mundus combinatus*, pp. 92–110; Ingrid D. Rowland, "Athanasius Kircher, Giordano Bruno, and the *Panspermia* of the Infinite Universe," in Findlen, *Kircher*, pp. 191–205.

[8]*MS*, XII.1.1, 327. On the chemical notion of *spiritus*, see especially Allen G. Debus, "Chemistry and the Quest for a Material Spirit of Life in the Seventeenth Century," in *Spiritus*, ed. Marta Fattori and Massimo L. Bianchi (Rome: Ateneo, 1984), pp. 245–263; Antonio Clericuzio, "The Internal Laboratory: The Chemical Reinterpretation of Medical Spirits in England (1650–1680)," in *Alchemy and Chemistry in the 16th and 17th Centuries*, eds. Piyo Rattansi and Antonio Clericuzio (Dordrecht: Kluwer, 1994), pp. 51–83.

Thus this "salino-sulfuro-mercurial vapor" is the universal seed for Kircher. It is by this *spiritus* that figures and colors are given to natural things. It is also called "the world's offspring" (*fœtura mundi*) or "the first-born seed" (*semen primogenium*), introduced into the chaotic mass by the divine Architect. What is more important for us in this development is the fact that Kircher qualifies this vapor as an "architectonic spirit" (*spiritus architectonicus*). We should note here that it is Anselmus Boetius de Boodt (1550–1632), physician to Emperor Rudolf II of Prague, who, under the clear influence of the French Paracelsian Joseph Du Chesne *alias* Quercetanus (1546–1609), developed the idea of an "architectonic spirit" related to the concept of seeds.[9] In his extremely influential mineralogical work *Gemmarum et lapidum historia* (Hanau, 1609), de Boodt used this idea to explain the introduction of vegetable fecundity into the world at the time of the Creation according to Genesis 1:11.[10] His idea was so influential that the leading natural philosophers of the first half of the seventeenth century like Daniel Sennert (1572–1637) and Pierre Gassendi (1592–1655) accepted it for their explanation of mineral formation.[11] There is textual evidence to show that Kircher knew the work of the emperor's mineralogist very well. Thus, Kircher's theory should be considered as part of the tradition of the Renaissance concept of seeds developed by Paracelsian chemical philosophers to interpret the Creation story of Genesis.

According to Kircher, this single seminal vapor produces diverse things according to the nature of the matrix: minerals arise in an inanimate matrix, plants in a vegetable one and animals in an animate one. In these places, the vapor is individualized by a combination known only to God. Kircher calls this individualized seed "the particular seed" (*semen particulare*). For him, the four elements, which are traditionally considered as material causes of natural things, are only the remote matter of generation, whereas the universal seed is the immediate one. It should be underlined here that Kircher's universal seed is made from these corporeal elements and is thus material. This aspect is reminiscent of the ideas of the Polish alchemist Michael Sendivogius (1566–1636). In his very popular work *Novum lumen chymicum* (Frankfurt, 1604), Sendivogius developed the idea that the universal seed of all things results from the subtlest part of the four elements.[12] Moreover, according to

[9]On Quercetanus, see Hiro Hirai, "Paracelsisme, néoplatonisme et médecine hermétique dans la théorie de la matière de Joseph Du Chesne à travers son *Ad veritatem hermeticae medicinae* (1604)," *Archives internationales d'histoire des sciences*, 51 (2001): 9–37.

[10]On de Boodt, see *DSB*, 2 (1970), pp. 292–293; Robert Halleux, "L'œuvre minéralogique d'Anselme Boèce de Boodt (1550–1632)," *Histoire et Nature*, 14 (1979): 63–78; Hirai, *Le concept de semence*, pp. 375–399, and "Les *Paradoxes* d'Etienne de Clave et le concept de semence dans sa minéralogie," *Corpus: revue de philosophie*, 39 (2001): 45–71, esp. 59–66.

[11]See Hirai, *Le concept de semence*, pp. 405, 484; Hiro Hirai and Hideyuki Yoshimoto, "Anatomizing the Sceptical Chymist: Robert Boyle and the Secret of his Early Sources on the Growth of Metals," *Early Science and Medicine*, 10 (2005): 453–477.

[12]Hirai, *Le concept de semence*, pp. 351–374.

Kircher, when the universal seed, diffused all through the earth, is absorbed by plants and made into a particular seed in them, its hidden vegetative power is transferred and, being activated, governs the vegetative functions of the plants. He also calls this seminal *spiritus* "the native light" (*lux primigenia*) that furnishes the power of the vegetative soul. For him, this *spiritus*, as the origin of the vegetative soul, works in the plants just like solar rays in the visible world. Kircher adds that in this seed lies hidden the vegetative soul under the form of "a very tiny spark" (*minima scintillula*), which is, according to certain chemists, 8200 times smaller than the body of seed. Here we can see Kircher's clearest attachment to the tradition of chemical philosophy, because this number 8200 for the size of the invisible seed was advanced above all by Sendivogius, then accepted by Joan Baptista Van Helmont (1579–1644) and George Starkey (1628–65).[13]

The Three Principles and the Influence of Paracelsianism

The fact that Kircher calls the universal seed "the salino-sulfuro-mercurial vapor" well illustrates a particular impact of Paracelsianism on his thought. He makes clear that this seminal *spiritus* does not result from the common minerals that share the same names (salt, sulfur and mercury). For him, this insensible *spiritus* manifests itself through spagyric dissolution: Sulfur appearing in the form of inflammable oil, Mercury in the form of liquor, and Salt in the form of salts and ashes. Kircher goes further to say that in order that the saline force always emerges with the sulfureous one and the mercurial one, Nature gathered them into a single saline body as the foundation of all things. This special entity is called the Salt of Nature (*sal naturae*). For Kircher, the three principles, being united, are enclosed in this salt endowed with a triple power, on which God imprinted the seal of his Holy Trinity. Identifying it with the universal seed, Kircher affirms that this triple power is life's fire, whose sulfureous part corresponds to the hot, its mercurial part to radical moisture, and its saline part to what confers substance to things. Then, he connects this triple power of the Salt of Nature to celestial matter by the famous phrase of Aristotle's *On the Generation of Animals*, 2.3, which establishes a close connection between seminal force and the *aether*. He says:

> Thus, each of these [three principles is called] rightly by philosophers: "the fire of Nature" by Albertus Magnus, "the world's seed" by Plato, "the entelecheia" or "the moving power of all things" by Aristotle (heat, yet not fire nor any such faculty, but the *spiritus* which is contained within

[13] *MS*, XII.3.1, 379. Cf. Hirai, *Le concept de semence*, pp. 360, 365, and 369; William R. Newman, *Gehennical Fire: The Lives of George Starkey, an American Alchemist in the Scientific Revolution* (Cambridge, MA: Harvard University Press, 1994), p. 87.

> the seed and its foam-like body, so that the nature which is in this *spiritus* corresponds by analogy to the element of stars, i.e. the one in which reside very intimately the soul and the plastic power, which cannot be caught by sense at all and which is not any such moisture discerned in visible sperm, but something spirituous and of celestial nature, lying hidden in it), and finally by Hermetists "the seed of Nature," whence all sensible things receive their origin.[14]

We clearly see here that not only Plato and Aristotle but also Albertus Magnus and "Hermetists" are invoked to establish a consensus on the ethereal nature of the universal seed. But that is not all. Kircher goes further to identify this Salt of Nature with the famous "something divine" (*to theion*) of Hippocrates as well as the Philosophers' Stone of the alchemists.[15] Thus, despite his criticism of alchemical transmutation, chymical ideas have not at all vanished from Kircher's thought.[16] On the contrary, the Jesuit father was very partial to themes developed in the tradition of Renaissance chemical philosophy.

Plastic Power

Kircher's concept of seeds contains another feature that played an important role in its notoriety. This is the notion of plastic force (*vis plastica*).[17] According to Kircher, God accorded to the universal seed two natural properties for the organization of all things. One is a plastic power (*virtus plastica*) that gives each thing its form, figure and color; the other is a magnetic power (*virtus magnetica*) that attracts similar bodies and assists the plastic power. Kircher deplores that there is virtually no one who can teach the true nature of this plastic power. One exception is his friend Johann Marcus Marci (1595–1667), for he showed its immediate causes in his work *Idea of Operative Ideas* (Prague,

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[14]*MS*, XII.1.1, 329. Cf. Aristotle, *On the Generation of Animals*, 2.3, 736b35–737a1.

[15]On Hippocrates's idea of "divine," see Antoine Thivel, "Le 'divin' dans la *Collection hippocratique*," in *La collection hippocratique et son rôle dans l'histoire de la médecine* (Leiden: Brill, 1975), pp. 57–76; Hiro Hirai, "Alter Galenus: Jean Fernel et son interprétation platonico-chrétienne de Galien," *Early Science and Medicine*, 10 (2005): 1–35, esp. p. 3.

[16]See Martha R. Baldwin, "Alchemy and the Society of Jesus in the Seventeenth Century: Strange Bedfellows?," *Ambix*, 40 (1993): 41–64, esp. pp. 46–54. Cf. Sylvain Matton, "Les théologiens de la Compagnie de Jésus et l'alchimie," in *Aspects de la tradition alchimique au XVII^e siècle*, ed. Frank Greiner (Paris: SEHA, 1998), pp. 382–501.

[17]See Gutmann, *Kircher*, pp. 35–39; Leinkauf, *Mundus combinatus*, pp. 107–08. Cf. William B. Hunter, Jr., "The Seventeenth Century Doctrine of Plastic Nature," *Harvard Theological Review*, 43 (1950): 197–213; Hiro Hirai, "Semence, vertu formatrice et intellect agent chez Nicolò Leoniceno entre la tradition arabo-latine et la renaissance des commentateurs grecs," *Early Science and Medicine*, 12 (2007): 91–122; "The Invisible Hand of God in Seeds: Jacob Schegk's Theory of Plastic Faculty," *Early Science and Medicine*, 12 (2007), forthcoming.

1635).[18] Thus, for the notion of plastic power, Kircher makes clear his debt to Marci.

Kircher first affirms that although the plastic power cannot form an organic body in the mineral kingdom, it can at least imprint there something analogous to plants and animals. He even says that the power that forms polygonal figures in gems cannot be properly called "plastic." For him, their generation comes about through the juxtaposition of similar corpuscles thanks to a saline power similar to a plastic one. In contrast, the plastic power is clearly at work in the vegetable and animal kingdoms. It organizes living beings by its radiating force according to the nature of each species. To explain this radiation, Kircher makes recourse to experiments with the *camera obscura*. According to him, when the figure of a man is exposed to rays of light introduced into a dark room, the "species" (*species*) of the man are projected on the wall of the room. After radiating from each point of the figure, the rays are united, while still retaining their individual natures, at the pinhole of the *camera obscura*; although they seem to be simple and uniform to human perception, there actually exist there various species endowed with the proper colors of each part. Thus, for Kircher, the radiation of the plastic power is similar to the radiation of light. Just as there can be diverse forms in a ray of light, a diversity of figures and colors can be contained in a single seed. Kircher also compares the light-like diffusion of the plastic power to that of the divine intelligence. In fact, he follows the discussions of Marci very closely for these developments.

Spontaneous Generation and Corpuscles of Life

Building upon all these ideas, Kircher then takes up the problem of the origin of living beings that are believed to be born spontaneously.[19] From the begin-

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[18]On Marci, see *DSB*, 9 (1974), pp. 96–98; Walter Pagel, *William Harvey's Biological Ideas* (Basel: Karger, 1967), pp. 285–323; John Flechter, "Johann Marcus Marci Writes to Athanasius Kircher," *Janus*, 59 (1972): 95–118; Giuliana Mocchi, *Idea, mente, specie: platonismo e scienza in Johannes Marcus Marci (1595–1667)* (Soveria Mannelli: Rubbettino, 1990); Margaret D. Garber, "Chymical Wonders of Light: J. Marcus Marci's Seventeenth-Century Bohemian Optics," *Early Science and Medicine*, 10 (2005): 478–509 and "Transitioning from Transubstantiation to Transmutation: Catholic Anxieties over Chymical Matter Theory at the University of Prague," in this volume.

[19]On the history of ideas on spontaneous generation, see among others Edmund O. von Lippmann, *Urzeugung und Lebenskraft* (Berlin: Springer, 1933); Everett Mendelsohn, "Philosophical Biology *vs* Experimental Biology: Spontaneous Generation in the Seventeenth Century," in *Actes du XII^e congrès international d'histoire des sciences* (Paris, 1971), Vol. 1-B, pp. 201–226; John Farley, *The Spontaneous Generation Controversy from Descartes to Oparin* (Baltimore: Johns Hopkins University Press, 1974); Remke Kruk, "A Frothy Bubble: Spontaneous Generation in the Medieval Islamic Tradition," *Journal of Semitic Studies*, 35 (1990): 265–282; Maaike Van Der Lugt, *Le ver, le démon et la vierge: les théories médiévales de la génération extraordinaire* (Paris: Belles Lettres, 2004).

ning, he clearly affirms that although insects and other inferior living beings seem to arise from putrefied matter, the four elements alone cannot produce them; they need something that plays the role of a seed. Kircher calls this seminal entity "the separated seed" (*semen decisum*). According to him, the universal seed, individualized in living beings as a particular seed, is diffused throughout their body. If this seed drops from the body, thus losing its original power and nature, it becomes a separated seed. This separated seed can still generate living beings, but only in a degenerated form. Since the plastic power in the usual visible seeds of natural things (like vegetable seeds and animal sperms) is protected by manifest covers, it can maintain its original heat. But in the case of separated seeds, the unprotected plastic power weakens and therefore gives rise to imperfect living beings. Thus, in Kircher, the secret of the difference between natural reproduction and so-called spontaneous generation lies in the strength of the seminal heat.

Kircher also tackles the question of the origin of life in this context. For him, the substantial forms of living beings, except the human soul, are drawn only from the potentiality of matter. Since these forms are drawn from matter, they must be material. Yet he adds that something formal lies hidden with a portion of particular seed in every part of a living body and its corpse. Identifying this "something" with a seminal form, he then argues that in the center of the separated seed lies hidden a *spiritus*, which gives life to matter. Kircher goes further to consider these separated seeds of living beings as minute corpuscles, easily carried in the air and dispersed everywhere by rains and winds. If these corpuscles find a proper matrix, they can form a "web of life" (*tela vitae*) by means of their inner plastic power.[20] According to Kircher, a certain life force must remain hidden in the corpse of beings that were once animated. When the body was animated, this force participated in the vegetative soul; but by remaining now in the dead body, it can generate living beings which are similar but inferior to the original animal. Kircher concludes that living beings cannot spontaneously arise except from matter that was once animated. He adds that "something" of the soul enclosed in the body of living beings can persist in the dead body and retain a portion of the seminal plastic power even after death. He explains this "something" as follows:

> That is why the most immediate matter of the generation of beings spontaneously born is our seed in which lies hidden a *spiritus*, as if [it is] a certain soul separated from living being (as Fortunio Liceti rightly teaches) and remaining in its corpse, not as a form but as spirituous corpuscles of

[20]On Renaissance Aristotelian corpuscularism, see Christoph Lüthy, "An Aristotelian Watchdog as Avant-Garde Physicist: Julius Caesar Scaliger," *Monist*, 84 (2001): 542–561; William R. Newman, "Experimental Corpuscular Theory in Aristotelian Alchemy: From Geber to Sennert," in *Late Medieval and Early Modern Corpuscular Matter Theories*, ed. Christoph Lüthy et al. (Leiden: Brill, 2001), pp. 291–329.

> this living being, in which lies its soul left behind after its death like in a vase.[21]

Kircher links to this development the famous passage of Aristotle's *On the Generation of Animals* III: 11: "Animals and plants are formed in the earth and in the water because there is water in earth, and *spiritus* in water, and soul-heat in all *spiritus*, so that all things are in a way full of soul."[22] For Kircher, Aristotle clearly meant the separated seed by this phrase, because "water in earth" corresponds to the saline force, "*spiritus* in water" to the mercurial one, and "heat" to the sulfureous one. This triple force lies hidden in the separated seed that contains at its center a spirituous part like a certain soul separated from the body that was once animated. This force, if placed in a proper matrix, produces something vegetable or animal. For Kircher, living beings thus come to life from a dead body of a plant or animal. But he adds that at the death of living beings the force of their material soul weakens due to the disappearance of its heat and thus degenerates into an inferior essence. Thus its species changes substantially. The more the force weakens, the more inferior a being it produces: a zoophyte, a rudimentary plant, a mushroom and even an inanimate body if this force is totally deficient. Thus Kircher explains the origin of some plant fossils.[23]

Kircher then takes up the emergence of life from these seminal corpuscles that come from the bodies of formerly animated beings and that are subsequently dispersed everywhere in the world. When these corpuscles are gathered in the form of a glutinous body and fermented by ambient heat, they acquire a certain degree of heat suitable for the material soul hidden in them to emerge in the form of life. Kircher adds, however, that these corpuscles play the role of seeds only by analogy, because they are not the "seeds" properly speaking but certain "envelopes of seminal reasons" (*involucra seminalium rationum*).[24] These corpuscles come from formerly animated beings and retain in themselves only a small, weakened part of the material soul. Kircher clearly identifies this material soul with a *spiritus*. According to him, in the mass of matter concocted by ambient heat and disposed for life, this spirit-like material soul gives a substantial form, which vivifies the matter and fabricates a new living being. It should be noted here that Kircher's idea of corpuscles endowed with a portion of the spirit-like material soul recalls the theory of his

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[21]*MS*, XII.1.6, 337.
[22]Aristotle, *On the Generation of Animals*, 3.11, 762a18–21.
[23]On the problem of fossilization, see also the insufficient attempt of Stephen J. Gould, "Father Athanasius on the Isthmus of a Middle State: Understanding Kircher's Paleontology," in Findlen, *Kircher*, pp. 207–237.
[24]On seminal reasons in the Renaissance, see Hiro Hirai, "Concepts of Seeds and Nature in the Work of Marsilio Ficino," in *Marsilio Ficino: His Theology, His Philosophy, His Legacy*, eds. Michael J. B. Allen and Varely Rees (Leiden: Brill, 2002), pp. 257–284, and "Concept of Seeds in the Mineralogy and Cosmogony of Paracelsus," forthcoming.

friend Gassendi, for whom some "molecules" (*moleculae*), also called "the seeds of things" (*semina rerum*), and made of atoms by God in the Creation of the world, are endowed with a corporeal "little soul" (*animula*), identified with the spirituous "little flame" (*flammula*).[25]

After all these discussions, Kircher asks his readers not to conceive the birth of degenerated beings as "spontaneous" generation. This sort of a generation cannot be considered as absolutely spontaneous. Since no part of the world lacks corpuscles derived from the body of formerly animated beings, it is not surprising that these residual seminal corpuscles, gathered together, united with humidity into a glutinous body, and fermented by ambient heat, can become a mass of disposed matter. Its inner material soul, that is, the life-giving *spiritus*, furnishes a substantial form that vivifies the matter. By means of its plastic power, this form fabricates a body in the form of plant or animal. Thus Kircher clearly denies "abiogenesis," that is, the generation of life from purely non-living matter.[26]

A Brief Look at Kircher's Sources

We have seen the main lines of Kircher's theory on spontaneous generation and his related ideas such as *panspermia*, chaotic matter, universal seed, and plastic power. His corpuscular conception of the emergence of life is remarkable and certainly demands further study. At the present stage, we shall provide only a brief look at his sources. As mentioned above, his theory of life-giving corpuscles recalls Gassendi's idea of seminal molecules. But is there any other possible source for this development? Among the atomists of the first generation of the seventeenth century, Sennert can be considered an interesting candidate because he wrote a treatise entitled *De spontaneo viventium ortu*, included in his major work the *Hypomnemata physica* (Frankfurt, 1636). Unfortunately, it is not easy to find clear borrowings from Sennert in Kircher's discussions. We know, however, that Sennert expresses high esteem for a certain Paduan doctor's theory of spontaneous generation—namely that of Fortunio Liceti (1577–1657), a figure totally neglected by historians. This man indeed published a large-scale work of the same title *De spontaneo viventium ortu* (Vicenza, 1618).[27] If we actually turn to this treatise, we may be sur-

[25]See Hiro Hirai, "Le concept de semence de Pierre Gassendi entre les théories de la matière et les sciences de la vie au XVII^{e} siècle," *Medicina nei Secoli*, 15 (2003): 205–226, esp. pp. 215–218, and *Le concept de semence*, pp. 479–486.

[26]On abiogenesis, see Edward T. Foote, "Harvey: Spontaneous Generation and the Egg," *Annals of Science*, 25 (1969): 139–163.

[27]See *Dizionario biografico degli italiani*, 65 (2005), pp. 69–73; Carlo Castellani, "Le problème de la *generatio spontanea* dans l'œuvre de Fortunio Liceti," *Revue de synthèse*, 89 (1968): 323–340; Hiro Hirai, "Earth's Soul and Spontaneous Generation: Fortunio Liceti's Criticism against Ficino's Ideas on the Origin of Life," in *Laus Platonici Philosophi: Marsilio Ficino and His Influence*, ed. Stephen Clucas et al. (Leiden: Brill, forthcoming).

prised to find that Kircher plagiarized Liceti's discussions at great length and sometimes almost *verbatim*, in particular in regard to the corpuscular conception of the origin of life.[28] It might even be said that Kircher's own notoriety completely erased the name of Liceti in this regard. What Kircher supplied on his own is a set of considerations derived from the chemical philosophy of a Paracelsian flavor still active in the middle of the seventeenth century. Thus, we can conclude that Kircher's synthesis is a curious combination of Liceti's corpuscular views of the origin of life, Paracelsian chemical ideas, and Marci's optical theory of the plastic power.

[28]See especially Fortunio Liceti, *De spontaneo viventium ortu* (Vicenza, 1618), III.13, 206, and *MS*, XII.1.7, 338.