Daniel Sennert on Matter and Form: At the Juncture of the Old and the New

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Introduction

Daniel Sennert (1572-1637), born in Breslau in Germany (now Poland), was a student and then professor of medicine at the University of Wittenberg, the intellectual center of Lutheranism. He was a renowned physician, and an extremely prolific and influential writer, whose popularity in his time is clear from the many editions of his works, many of which were translated into English.

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2 For discussion of Sennert’s life, see A. Buchner, Panegyric... (Wittenberg, 1638); and Dissertationes Academicae, (Wittenberg, 1651), vol. 2; H. Kangro, “Sennert,” ed. Ch. C. Gillispie, Dictionary of Scientific Biography, (New York, 1975), 12: 310-313. For secondary literature on Sennert, see H. Kangro, ibid., 313; and Joachim Jungius’ Experimente und Gedanken zur Begründung der Chemie als Wissenschaft (Wiesbaden, 1968), 407.

3 Editions of Sennert’s works on natural philosophy, medicine and chemistry, were published in many countries. A sample of editions of his works relevant to my topic follow: De Febribus (Wittenberg, 1605, 1619; Lyons, 1627; Wittenberg, 1628; Paris, 1633; Venice, 1641; Wittenberg and Frankfurt, 1653); Epitome Institutionum Medicinae (Wittenberg, 1631, 1634; Lyons, 1645; Amsterdam, 1644, 1655; Wittenberg, 1664); Institutionum Medicinae libri V (Wittenberg, 1611, 1620, 1628; Paris, 1631; Wittenberg, 1638; Paris, 1637; Wittenberg 1646, 1667); Epitome Naturals Scientiae (Wittenberg, 1618, 1624; Oxford, 1632; Wittenberg and Paris, 1633; Venice, 1641; Frankfurt, 1650; Amsterdam, 1651; Oxford, 1653, 1664, 1682); De Chymicorum cum Aristotelics et cum Galenicis consensu ac dissensus liber I (Wittenberg, 1619, 1629; Paris, 1633; Frankfurt and Wittenberg, 1655); Opera Omnia (Paris, 1641; Venice, 1641; Lyons, 1650; Venice, 1651; Lyons, 1676). (Sennert’s Opera Omnia, 3 vols., Lyons, 1650, will be cited hereafter as “O”).

4 See, for example, Doctor D. Sennertus Of Agues and Fevers. Their Differences, Signes, and Cure, transl. N.D.B.M. of Trinity College Cambridge (London, 1658);
in the seventeenth century. His writings were informed by a vast range of sources: he cites philosophers, chemists and physicians, ancient, medieval and modern. My aim in this study is to show that Sennert, at the dawn of early modern science and the twilight of Aristotelian science, is of interest as an archetypical transitional figure. It is well known that he adopted a corpuscular matter theory, and that he defended this by the evidence of chemistry. Here I will focus on a largely unknown influence on Sennert's theory of matter and form, viz., an Aristotelian approach that was widely accepted in early seventeenth-century Germany. This approach, which is to be identified in what follows as Latin pluralism, had an influence on Sennert's earliest work, published in 1600, a year before he received his medical degree. I will explore the nature of Sennert's Latin pluralism and its impact on his mature account of matter and form.

We have evidence of Sennert's final view of form and matter in his Hypomnemata Physica, a collection of essays described as "second thoughts or meditations" and published in 1636, a year

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13. Books of Natural Philosophy, transl. A. Cole and N. Culpeper (London, 1659); Chymistry made easie and useful or, the agreement and disagreement of the chymists and Galenists, transl. A. Cole and N. Culpeper (London, 1662).


6 Epitome naturalis scientiae, comprehensa disputationibus viginit sex, in [...] Academia Wittenbergensis [...] propositis a M. Daniele Sennerto (Wittenberg, 1600). This work is based on disputations, dated 1599 to 1600, and written by Sennert for students at Wittenberg. The first third of Sennert's 1618 Epitome Naturalis Scientiae is largely a duplication of these disputations.

7 Sennert's Hypomnemata Physica (Wittenberg, 1636) consists of five essays that provide a detailed explanation of topics in his earlier writings that were the subject of controversy, viz., his doctrine of the origin of forms, occult qualities and diseases of the whole substance, atoms, the generation of living things, and spontaneous generation (noted hereafter as "HP").

8 HP, O, 1:135: "δευτέρας φαντάζας & [...] meditationes."
before his death. In his *Hypomnemata Physica*, Sennert explains, against a recent virulent attack by Johannes Freitag and others, that he is not among those innovators who, like Paracelsus, reject Aristotle's view, but nonetheless, as a practicing scientist, employing the evidence of experience and experiment, he provides appropriate corrections of this view. In one essay of his *Hypomnemata Physica*, viz., *On Atoms and the Mixed*, we find one such correction. Sennert here provides his one and only detailed discussion of atoms, and this is the usual source, for commentators, of his corpuscular matter theory. But, in this work, antithetical to the general direction of other early modern atomists, he expands the role of substantial forms. It might well be asked, why presume both atoms and forms? One reason for this is presented in another essay of the *Hypomnemata Physica*, viz. *The Generation of Living Things*. Here Sennert, in his analysis of the origin of forms, provides another correction of Aristotle’s view. In the final two sections, I will consider these innovations in Sennert’s Aristotelian framework, but first some clarification is required.

As Roger Ariew points out, Thomas Aquinas was, in 1567, named Doctor of the Catholic Church, but nonetheless the non-Thomistic analysis of form and matter of John Duns Scotus was adopted by various French thinkers in the early seventeenth century. The fact is that this is but one part of a larger story. A virulent debate among early scholastics over the correct interpretation of Aristotle’s view of his fundamental principles, form and matter, divided Aristotelians into two camps from the begin-

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9 Johannes Freitag (1581-1641), professor of medicine in Groningen, published three disputations attacking views of Sennert: *Disputatio medica calidi innati* (Groningen, 1632); *Disputatio medica de morbis substantiae* (Groningen, 1632); *Disputatio medico philosophica de formarum origine*... (Groningen, 1633). Sennert was, in turn, defended by Johannes Sperling (1603-1658): *Tractatus physico-medicus de calido innato*, pro D. Daniele Sennerto contra D.J. Freitag (Lipsiae, 1634); *Tractatus physico-medicus de morbis totius substantiae, et cognatis questionibus*... (Wittenberg, 1634); *Tractatus physico-medicus de origine formarum*... (Wittenberg, 1634). Freitag then published *Detectio et Solida Refutatio Nova Sectae Sennertoparacelsicae* (Amsterdam, 1636), to which Sperling again replied in his *Defensio Tractatus De Origine Formarum*, pro D. Daniele Sennerto & c. Contra D. Johannem Freitag & c. (Wittenberg, 1638). Sennert responded to Freitag’s attack in his 1636 *Hypomnemata Physica*. For a further complication in this story, see Sennert’s attack on Freitag’s “inanem operam” in his discussion of opium, in *Practicae Medicinae*, lib. 6, O. 3: 632-633.

10 HP, O, 1:136.

nings of scholasticism in the thirteenth century until its demise in the eighteenth century. One interpretation of form and matter, influenced, in particular by Thomas Aquinas, is very familiar. The other, that of the Latin pluralists, was supported in the thirteenth century by such Franciscans as William de la Mare, Richard of Middleton, Roger Marston and Peter John Olivi, culminating in the influential analyses of two Franciscans, Scotus and Ockham, and this non-Thomistic approach, continuing into the early modern period, was adopted by such seventeenth-century Aristotelians as Fortunato Liceti in Italy, Eustachius a Sancto Paulo in France, Petrus Bertius in Holland, and Christoph Scheibler in Germany. This now little known non-Thomistic approach, which provides the theoretical context of Sennert’s earliest account of form and matter, is the subject of the following section.

1. Sennert’s Aristotelian Pluralism

Daniel Sennert maintains, as do all Aristotelians, that prime matter and substantial forms are the fundamental principles of what exists, but in his analysis of these two fundamental principles, he accepts the following distinctive theses:

TS1: Prime matter has a reality of its own.
TS2: There are two kinds of substantial forms, subordinate and supervening.
TS3: Each living thing has a plurality of substantial forms and a plurality of grades of matter.

Sennert, considering matter, maintains that though prime matter cannot actually exist apart from form, it has a “proper essence and being of its own.” He argues: Mutable bodies are divisible.

12 For an excellent study of this medieval controversy, along with texts of particular pluralists, see R. Zavalloni, O.F.M., Richard de Mediavilla et la controverse sur la pluralité des formes (Louvain, 1951). For discussion of this controversy, with detailed consideration of the Thomistic opponents of pluralism, see F. J. Roensch, Early Thomistic School (Dubuque, Iowa, 1964).

13 For discussion of this Franciscan tradition and of this controversy in the medieval period, see my paper: “Averroes and the Plurality of Forms,” Franciscan Studies 52 (1992), 155-182.

But forms are unextended and hence indivisible. Thus extension (length, breadth and depth) must be essential to matter. He concludes that prime matter provides corporeality to bodies; it has extension, but its extension is indeterminate. By this he means that parts of prime matter have no specific length, breadth or depth unless determined by a substantial form. So Sennert says of prime matter: “Matter gives corporeity and an indeterminate magnitude to things, and it has a capacity to receive forms and a determinate figure [...].”

Further Sennert, using the term “form” for substantial forms (which he distinguishes from qualities), takes the view that forms make a thing what it is, but he distinguishes two kinds of forms in natural things, subordinate and supervening. Sennert, supporting a plurality of grades of matter and related forms, contends, citing Scaliger, that “it is not absurd to maintain that there are many forms in one continued body.” From this viewpoint, an ultimate supervening form organizes and unites all subordinate forms as a single substance. So, he explains, “bodies that contain various forms besides the elements are termed compounds, such as are the bodies of all living things. Hence, that

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16 HP, O, 1:141: "[M]ateria corpulentiam & magnitudinem indeterminatam rebus tribuit, & potentiam habet formas & figuram determinatam recipiendi [...]." Sennert says from his earliest work (Disp. III, Thesis 17; also ENS, 56-7): "Naturam materiae proprie insequitur Quantitas, ipsiq; coaeva est, & nec re, nec cognitione ab ea separari potest." See also Disputation V "De Continuo et Infinito," Wittenberg, Sept. 26, 1599, thesis 1.

17 Sennert generally speaks not of accidental forms, but of qualities, which he says flow from forms, as a shadow does from a body. See, e.g., ENS, bk.1, ch. 6; HP, bk. 2, passim.

18 HP, O, 1:165: "Neque absurdum est, ut idem Scaliger [...] scribit, in continuo uno stauere plures formas."

19 Sennert argues that in a body, it is its matter that is essentially extended and is the principle of its mass and impenetrability. The result of this is that “two bodies can never be together in the same place,” (ENS, 64: “duo corpora nunc quam simul esse, nec unum cum altero simul eundem locum occupare potest”), while in the case of forms, “the presence of the one does not hinder the presence of the other” (“nec unius praesentia alterius praesentiam impedit," ibid.). Forms are unextended, but each is accidentally extended, wholly in each part of the body it determines. However, since forms are essentially without extension, they are penetrable, so two or more forms can coexist in the same locus in a body.
form is more perfect that has more forms under its command.\textsuperscript{20}

From this viewpoint, Bossy the cow is composed of prime matter, which is the subject of the forms of the elements, and these, in turn, are matter for forms of mixed bodies, e.g., Bossy's blood, bones and flesh. Finally, Bossy's heterogeneous organic body is the matter for the supervening form that determines and activates that body, its life form or soul. This hierarchical framework is reflected in Sennert's work on speculative medicine, his \textit{Institutiones Medicinae}, where he follows Galen in distinguishing, in the structure of a human being, the elements, the seemingly homogeneous bodies, e.g., blood, bones, flesh, and the heterogeneous parts, called organs, e.g., hand, foot, brain, heart.

Some recent commentators claim that Sennert's pluralistic and hierarchical account is a departure from Aristotle's view. For example, Van Melsen explains that, in Aristotle's view, "if one admitted that some body was a compound, the logical conclusion had to be drawn that it possessed only one form.\textsuperscript{21} But, in Sennert's account of the elements, "the original forms of the elements are said to remain [in the compound]. This impaired the unity of the compound in virtue of the rule: one substance means one form, and a plurality of forms means a plurality of substances."\textsuperscript{22}

So Van Melsen says of Sennert's hierarchical account: "\[A\]n empirical knowledge had grown, which, on one hand flatly contradicted Aristotle's teaching, and on the other was so new that it could not be suitably expressed in terms of Aristotle's philosophy."\textsuperscript{23} Dijksterhuis also asserts that Aristotelianism is not really consistent with a corpuscular matter theory. He explains that Sennert, to reassure his philosophic conscience, introduces subordinate and higher forms, which "had always been unanimously

\textsuperscript{20} HP, O, 1:147: "Hic quod corpora alia simplicia, alia composita, & quod alia magis, alia minus composita esse dicunt, id non sit ratione materiae primae & elementorum, sed ratione formarum. [...] Quia vero formae aliae alias praesupponunt, [...] talia corpora quae praeter elementa plures formas continent, composita dicuntur, qualia corpora sunt omnia viventia. Hinc perfection est illa forma, quae plures subieactas habet, quibus dominetur."


\textsuperscript{22} Ibid., 125.

\textsuperscript{23} Ibid., 126.

\textsuperscript{24} E. J. Dijksterhuis, \textit{The Mechanization of the World Picture} (Oxford, 1961), 289. See also L. S. King, "The Transformation of Galenism," \textit{Medicine in Seventeenth Century England} (Berkeley, etc., 1974), 7-32, who discusses Sennert's hierarchical account of forms, which, he says, Sennert in his analysis of atoms "extends and elaborates" (p. 27); but King, attributing this principally to Sennert's Galenism,
rejected by the scholastic philosophers.\textsuperscript{24} The fact is that these commentators take the Thomistic account of form and matter to be Aristotle's own view, and they fail to take into account the non-Thomistic Aristotelian analysis of the structure of substances above identified as Latin pluralism. But, as indicated above, both of these views (unicitism and pluralism) had an equally long history as rival interpretations of form and matter, beginning in the thirteenth century. What's more, Sennert's theses were key theses of the Latin pluralists.

The more familiar unicitist account, presented by, for example, Toletus and the Coimbra Commentators,\textsuperscript{25} and influenced, in particular, by Aquinas, is in conflict with Sennert's fundamental theses (TS1-TS3 above), and maintains instead:\textsuperscript{26}

TT1: Prime matter is pure potentiality.
TT2: Each substantial form is an absolute and immutable actuality that completely determines the nature of an individual substance.
TT3: Each substance has just one substantial form that inheres in prime matter.

From this viewpoint, each individual entity is composed of, first, prime matter, which is pure potentiality, not really anything at all apart from form, incognizable even by God; and, second, inhering in prime matter, an actuality, one substantial form, which makes an individual what it is. In each living thing, a soul inhering in prime matter is the one substantial form that determines the nature of a living body, and this soul has powers that activate that body. In human beings, the one substantial form is a rational soul, and intellect is one faculty or power of the rational soul,

concludes: "Seventeenth-century corpuscular philosophy can, I believe, be considered the lineal descendant of Galenic teachings as modified through the centuries" (p. 51).

\textsuperscript{25} Sennert cites and attacks views of both Toletus and the Coimbra Commentators that are implications of their unicitist account of form and matter. Cf. e.g. his reference to a "shameful" ("turpissime") view on corruption of the Coimbra Commentators (HP, O, 1:165), and his claim that "the form of an embryo (as it is described by Toletus [...] is a pure figment." ("formam embryonis, ut à Toleto [...] descriptur, esse merum figmentum;" HP, O, 1:203).

along with nutrition, sensation, local motion and appetite.

Here, it is claimed, on grounds of per se unity, that one substance must have one substantial form. Followers of Aquinas argue: 27 If a substance has two forms, then it has two actualities, and so it is then two distinct substances, not one. 28 It is true that Sennert’s pluralistic account of substantial forms has no place in this framework. For unicists, a hierarchy of substantial forms in a thing or any actuality in prime matter are ruled out. But this Thomistic approach is not the interpretation of Aristotle’s view of form and matter that was adopted by Sennert or by his colleagues at Wittenberg.

In the early seventeenth century, philosophers and theologians at the University of Wittenberg adopted, as Sennert did, TS1-TS3. For example, Jacob Martini (1570-1649), in his Metaphysical Exercises, claims, beyond a substantive prime matter, three grades of matter, viz. the elements, homogeneous substances (blood, bones, and flesh), and, finally, the organic parts composing a whole living body. 29 And Martini, like Balthasar Meisner, also maintains that each living thing has many substantial forms. 30 Meisner (1587-1626), Wittenberg professor of theology, contends that it is true that each thing is one by one substantial form, but this is an ultimate form. In addition, there are many subordinate forms. Meisner distinguishes partial and total forms (determining parts and determining the whole body). He further distinguishes generic and specific forms. In his words: “Thus one man has one form, namely one specific [form], which is the rational soul; he has

27 Th. Aquinas, Summa Theologica, q. 76, art.4.
28 This argument from per se unity of a substance is a key argument of the unicists. It is presented, for example, by John Major, a nominalist and follower of Ockham in his logic, and by Gabriel Biel, well-known as an Ockhamist in his account of universals. Both, unlike Ockham (who claims the reality of matter and the plurality of forms), support a unicist account of form and matter.
29 J. Martini, Exercitationum Metaphysicarum Libri duo ... (Cologne, 1611). (The dedication is dated 1608.)
30 Martini, ibid., 151, supporting the real distinctness of body and soul (and hence distinct corporeal and psychic forms), argues: “Quando enim anima per mortem resolvitur a corpore, manet forma misti in cadavere. [...] Deinde non possunt contrarii motus ab uno simplici proficisci principio una simplici virtute. Contrarios autem motus in animatis experimur: anima enim movet sursum: forma praedominantis elementi deorsum. Verissima itaque [...] in animatis ad minimum duos dari formarum gradus, corporeitatem, ut mixti formam vocat Scotus, & animam. [...] Rejicimus itaque opinionem illorum, qui non tantum in simplicibus & mixtu, sed etiam in omnibus animalibus unam tantum formam agnoscent, Thom.l. part. q.76. art.4.”
nevertheless many generic [forms], such as the sentient soul, the vegetative soul, the form of the mixed body, & c." A similar view is presented by other German thinkers of this period such as Christoph Scheibler. All acknowledge, as a source of their pluralistic interpretation of Aristotle’s view, in particular, late Renaissance Paduan philosopher, Iacopo Zabarella, who will serve as a representative Latin pluralist in what follows.

Iacopo Zabarella (1533-1589), was a prominent and influential professor first of logic (1564-69), and then of natural philosophy (1569-89) at the renowned University of Padua, one of the foremost medical schools in Europe. In the late sixteenth century, two professors of medicine, P. Scherb at Altdorf and J. L. Havenreuter at Strasbourg, were instrumental in introducing to Germany Zabarella’s thought, as, according to one commentator, the principal foundation on which neo-Aristotelianism in Protes-

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32 Ch. Scheibler, *Liber de anima* (Giessen, 1614), 35, says (as does Sennert): “Zabarella tamen minus absurdum putat, sive tres sive decem sive centum ponatur formae in eodem composito, de fac. an. cap. 8. & confirmat hanc sententiam de gener. & inter. cap 2. inde, quia in homine duo distincti & contrarii sunt motus, anima, is ut progressio, & naturalis, quando motu recto cadit de turri. Ubi dici non potest quod hic motus sit ab anima, quia 1. anima movet per nervos, & 2. non movet per gravitatem. Cui rationi addo ego hanc. Si homo non habet plures formas. Ergo homo non erit corpus, non animal, non mixtum, quia haec omnia sunt per suas formas, id quod sunt. Si ergo haec universalia sint in homine, necesse est, ut etiam eorum formae sint in homine.”


34 Zabarella’s earliest biographer was A. Riccoboni, *De Gymnasio Patavino Commentariorum Libri VI* (Padua, 1598), 2: ch.42, p. 51. For a contemporary discussion of Zabarella’s life, works, and writings on logic, see Edwards, *The Logic*.

35 The most prestigious chairs of the arts faculty at Padua were those in the theory of medicine, the practice of medicine, and natural philosophy, which was propaedeutic to the study of medicine.
tant Germany was built. Many editions of Zabarella’s works were published in Germany; and he is frequently cited in early seventeenth-century works of such German thinkers as Gutkiess, Ursinus, Timpler, Keckermann, and Goclenius, as well as Sennert. Nor was his influence in Germany short-lived. For example, Leibniz indicates having studied, with great interest, a number of Zabarella’s treatises, and even Wolff, perhaps through the influence of Leibniz, shows a knowledge of this author.

Zabarella, like the many German Aristotelians that followed him, adopts TS1-TS3. The fact is that Zabarella was and remains a highly respected Aristotelian commentator. But this prominent Aristotelian takes a pluralistic and hierarchical account of form and matter to be the correct and the mainline interpretation of Aristotle’s own view, held by Aristotle’s Greek commentators, Alexander of Aphrodisias, Philoponus, Simplicius, as well as by Averroes and recent Averroists. Zabarella attributes the opposing unicist analysis to the Latins. He sees this analysis as originating with Aquinas and as a Latin misinterpretation of Aristotle’s view.

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37 See Edwards, 351: “[... ] Leibniz, who—besides saying in his autobiography that in his early studies he occupied himself pleasurably with Zabarella and other scholastic philosophers—cites Zabarella with a fair degree of frequency.” Leibniz refers to a number of essays in Zabarella’s *De Rebus Naturalibus*. Cf. C. Wolff, *Cosmologia Generalia*... (Frankfurt, 1737), 145, 212.  
39 In this position, Zabarella was not alone. Cf. e.g., his colleague at Padua, Francesco Piccolomini, *Librorum ad scientiam de natura attrinimentum partes V* (Venice, 1596), 87; or Franciscus Bonnæus, who, considering whether “in the same composite there exists a plurality of substantial forms,” states: “Thomas, with his sect, deny it; we believe rather Averroes and the Greek interpreters, who affirm it” (“In eodem vero composito an plures formae consistere valeant, inter Philosophosagitatum est. Thomas, cum suis sectoritibus, negat; nos Averrio, & Graecis interpretibus affirmantibus magis credimus”). F. Bonnæus, “De Formis Rerum Naturalium Substantialibus,” *Theses Physicae* (Geneva, 1612), 7.  
40 Zabarella,”*De Facultatibus Animae*,” 696-711.  
41 This is not to say that there is not often overlap between the theory of a particular pluralist and that of Aquinas, or even influence of Aquinas on some issues unrelated to theses presupposed or implied by pluralism. Cf. Zabarella’s
From his pluralist viewpoint, Zabarella, in his essay on matter, concludes that Scotus is correct in claiming that matter has a distinctive essence and has actuality. Next, arguing that matter must be divisible, he supports the claim that matter is the supreme genus of body (*corpus*) in two categories, those of substance and quantity. That is, matter, as the constant subject of change must itself be substantive, with extension, length, breadth and depth. Following Averroes, he characterizes this extension as indeterminate. What he says this means is that parts of matter have no necessary dimensions, but can vary when informed by differing forms. The lowest grade of forms are those of the elements, which are the simplest substances, the primary bodies; for the elements, from which all compound bodies are produced, are not composed of and cannot be further analyzed into any other substance. And the elements, as matter, are the ingredients of compound bodies, of gold or lead.

In his essay on mixed or compound bodies, Zabarella, explaining the generation of compound bodies from the elements, speaks of the reduction of the elements to "small parts," "so that each is able to penetrate parts of another." These elemental particles interact and change in intensity. The elemental forms are thereby transformed. This results in a median form, which determines a compound body. But Zabarella insists, the postulated "small parts" are not "absolute" particles, not atoms; matter is infinitely divisible. The interaction of elemental small parts, transforming the elemental forms as blue and yellow interacting produce green, gives rise to a single new form of a homogeneous mixed body such as gold or lead. The resulting compound body is continuous and uniform throughout.

In this Zabarellan account, the elements are not destroyed and replaced by another substance, as they are in the Thomistic view. From the Thomistic viewpoint, since a substance can have no more than one substantial form, when the mixed form is generated, the elemental forms are destroyed. The result is that the ele-

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support for the Thomistic view in his account of sensible species as entitative.
Sennert, likewise, cites such Thomists as Toletus, the Coimbra Commentators, Pereira and Ruvius in support of some views.

43 Zabarella, "Liber de mistione," 469: "[...] miscibilia primum debere se mutuo dividere in partes parvas, ideoque [...] posit aliorum partes penetrare."
ments themselves vanish, but they are said to remain ‘virtually,’ for the elemental qualities are a subset of the qualities of the new mixed form. Zabarella rejects, as lacking in any rationale, the Thomists’ mysterious disappearance of the elemental forms and the equally mysterious appearance of a new higher mixed form that has, as a subset of its qualities, those of the elements. This succession of different forms, he contends, does not explain Aristotle’s claim that the elements remain in a mixed body potentially. Instead, for Zabarella, in the interaction of the elementary “small parts,” the elemental forms are the ingredients of a new median form. The elements, serving as matter for a higher grade of form, are thereby transformed. So the elements are not destroyed, as in the Thomistic view; the elements themselves remain in an altered state.

Further, Zabarella, maintaining the real distinctness of body and soul, argues, for example, as follows: A bird with wings tied dropped from a tower will fall downwards, but if free it will soar upwards. The form of a thing is its principle of motion, but one and the same form cannot be the principle of concomitant contrary motions. So in our bird (as in each living thing), body and soul must be really distinct, with distinct substantial forms.

The result of this is that Socrates is composed of prime matter, and (inhering in this) the substantial forms of such homogeneous compound bodies as blood, bones, nerves, and the like. These serve, in turn, as the matter of three super-added psychic forms, i.e., a vegetative soul, which makes Socrates a living thing; a sensitive soul, which makes him an animal; and, finally, an ultimate specific form, a human rational soul or mind, which constricts and regulates, as its matter, all “subordinate” lower grades of forms. Cats and cows have a similar hierarchical structure but this is determined by a different ultimate specific form, viz. a cat or cow soul respectively.

Sennert cites and supports Zabarella’s conception of subordinate and specific forms. He says:

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44 This view of Aquinas, in fact, developed over time. For discussion of this development, see Zavalloni, Richard de Mediavilla, 264-265.
45 Cf. A. Achillini, De Elementis (Bologna,1505), for support of the pluralistic view that prime matter is substantive and extended, (p. 102a) and for a similar “Averroist” account of how mixed bodies arise from the elements by their breaking up into particles and their reduction to a middle state (pp.116-119).
46 See notes 30 and 32 above.
To me it seems more agreeable to truth that in living things there are various auxiliary and subordinate forms, yet so that one is principal and queen, [...].

and

Nor does it imply any absurdity that besides the specific form, there should be other subordinate forms; but as Zabarella, Lib. 1, de Generat. & Interit. Cap 2, writes, if it is not against reason that there should be two, neither is it that there should be four or a hundred together in the same subject.

Still, Sennert departs from Zabarella's pluralistic framework, for he claims, following Scaliger instead, that, in human beings and other animals, in addition to a plurality of subordinate forms of the body, i.e., of blood, bones, flesh, and the like, that there is just one soul, not three distinct hierarchically ordered souls. The fact is that Latin Pluralists, starting in the thirteenth century, adopted TS1-3, but nonetheless developed a multitude of competing accounts of the hierarchical structure of substances.

So, for example, Scotus claims that human beings have a subordinate form of the body and in addition one soul as the supervening form. Ockham claims that human beings have a form of the body and two souls, a mortal sensitive soul and a supervening immortal intellective soul. Paul of Venice, in his analysis of the structure of each human being, claims instead, first, really distinct forms of the elements, which are matter for forms of homo-

47 HP, O, 1:218: "Mihi vero magis consentaneum videtur, in corporibus viventibus plures formas succenturiatas esse, & subordinatas, ita tamen, ut una sit princeps & domina, quae vivens infor- mat, & a qua vivens nomen habet, ipsa scilicet viventis cuiusque anima [...]" On subordinate and supervening forms of living things, see also Disputation xv, "De generatione & interitu corporum naturalium," (Wittenberg, Dec. 21, 1600), thesis 7; and ENS, 220-222.

48 HP, O,1:218. "Neque aliquid absurdi importat, praeter formam specificam adhuc alias dari formas subordinatas, sed ut Zabarella, lib. 1. de generat. & inter., cap. 2, scribit, si duas simul esse, non repugnat rationi, nec quatuor, nec centum repugnat simul esse in eodem." Sennert also says of Schegk, "Germaniae Aristoteles." "Nihil absurdi erit, si in una substantia plures formas inesse dicamur;" and he cites Zabarella to support the view that, when dead, a body is reduced to the next lower grade of forms. He says: "Zabarella, Lib. de Generat. & Interitu, cap.4, also writes that the form of a mixed body in a living thing does not perform the role of a form with respect to the whole living creature, but rather that of the matter. But when the soul is taken away, the same form of the mixture begins to perform the role of a form and to constitute the body in a species." ("Zabarella quoque, lib. De generat. & interit. cap. 4. scribit, formam mitionis in vidente non fungi officio formae respectu ipsius viventis totius, sed potius materiae; sublata autem anima incipere eandem formam mitionis fungi officio formae, & corpus illud in specie constituisse," ibid.).
geneous mixed bodies (e.g., blood, bones, flesh), and, next, a mortal sensitive soul that inheres in the body, and, finally, an immortal intellect or mind, which is a single separated substance that, as Averroes claims, "is one for all men."\textsuperscript{49}

Hierarchical and pluralistic analyses of the structure of living things (presuming TS1-3) were common at the Renaissance Universities of Padua and Bologna from Paul of Venice in the early fifteenth century until Fortunio Liceti in the early seventeenth century.\textsuperscript{50} Nor was Renaissance Latin pluralism isolated to northern Italy. There were such Latin pluralists in Germany as, for example, Gregor Reisch, author of the influential \textit{Margarita Philosophica}, and P. Melanchthon, Luther's principal associate.

Sennert and his contemporaries inherited all these views. And influenced, in particular, by Zabarella, as indicated above, a pluralistic analysis of form and matter was adopted by prominent Lutherans in early seventeenth century Germany, and so too at Wittenberg. Sennert cites such recent Thomists as Toletus, Ruvius, Pereira, and the Coimbra Commentators, but he rejects the Thomistic view of matter and of form. Like his Wittenberg colleagues, he cites Zabarella repeatedly, as well as such other pluralists of the Paduan circle as F. Piccolomini, Zimara, Mercenario, Liceti, Eustachius Rudius,\textsuperscript{51} and, most frequently, Scaliger,\textsuperscript{52} and it is on the foundation of this pluralistic Aristotelianism that he constructed his account of the fundamental structure of natural


\textsuperscript{50} See, for example, Liceti's works: \textit{De Ortu Animae Humanae} (Genoa, 1602); \textit{De Rationalis Animas Varia Propensione ad Corpus libri duo} (Padua, 1634); \textit{De Animi rationalium immortalitate Libri Quatuor Aristotelis Opinionem Diligenter explicantes} (Padua, 1629). See also Zabarella's colleague and adversary (another source regularly cited by Sennert), Francesco Piccolomini, \textit{Liberum}, who, adopting TS1-TS3, similarly claims that prime matter has quantity or extension, and that a human being is determined by a plurality of really distinct substantial forms, \textit{viz.}, forms of homogeneous mixed bodies and two souls, (\textit{i.e.} as Ockham maintains, an extended and mortal organic soul and an unextended and immortal purely intellective mind).

\textsuperscript{51} Rudius was a Galenist physician at the University of Padua, who, in his \textit{Liber de anima} (Padua, 1611), combined his Galenism with a pluralistic account of the human soul (presuming Galenist mortal souls along with an immortal human mind).

\textsuperscript{52} Scaliger was born and studied in Padua. Thereafter, he left Italy.
substances. But, as indicated at the outset, Sennert, claiming to correct Aristotle’s view, developed a distinctive account of matter and form. These innovations are the subject of what follows.

2. Sennert’s Atoms

Sennert, in his 1636 *Hypomnemata Physica*, applies his hierarchical and pluralistic view not just to living things but to corpuscles. Here the elements are composed of indivisible atoms, atoms that are the smallest bodies. But atoms are still not the fundamental principles. The elemental atoms themselves are each composed of prime matter and a substantial form. Prime matter is the source of the extension of an atom, its quantity; its form is the source of its qualities. Sennert praises Democritus’ atomism, but unlike Democritus, he claims that proper sense qualities really belong to atoms (fire atoms are hot), but because they are so infinitesimally minute, individual atoms “cannot be perceived by the senses.”

Sennert uses the term “atom” for minuscule bodies that can be seen in conjunction, but that, because of their extreme smallness, cannot be seen separately. Sennert’s atoms are substances that can be characterized as follows:

1. The fundamental units of matter are extremely minute bodies called atoms, each of which has a specific substantial form.
2. The simplest atoms are atoms of the elements. Each is indivisible and immutable.
3. There are various grades of atoms, and each higher grade of atom is composed of an organization (or structure) of the next lower grade of atoms.
4. Each body that is not an atom is composed of bonded atoms.

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54 See note 17. There are two sorts of qualities: manifest qualities, those which can be perceived by the senses if a sufficient number of atoms are conjoined; and occult qualities, which cannot be perceived by the senses, but which can affect us.

55 HP, O.1:158: “Quae quidem in natura reverà sunt, tam parva verò sunt, ut sensibus non pateant.”
In Sennert’s hierarchical and pluralistic account, then, indivisible elemental atoms, united by a mixed substantial form, are bonded in different structures as the matter of compound atoms (or molecules). But, Sennert claims, some mixed bodies are reducible to others (e.g., metals to sulphur, salt and mercury), and a body is composed of that into which it is resolved. So, some compound atoms bond together as the matter for more complex atoms, such as those of gold and lead, blood and bones. Further, like atoms (i.e., those with the same specific form) bond together to form the visible bodies of the elements or compounds that we see, for, Sennert claims, like attracts like. So visible gold is composed of bonded gold molecules, each of which has a hierarchical and pluralistic structure. Finally, Sennert claims that the seeds of some living things are yet a higher grade of atoms; these are composed of a hierarchical structure of corpuscles, which are organized by a supervening specific form, viz. a soul.

As early as 1611, Sennert, describing chemical experiments in his Institutiones Medicinae, appears to presume a corpuscular matter theory of some sort. Citing Geber, an influential medieval chemist, he speaks of the reduction of metals into minimal parts or atoms by a variety of processes. Sennert’s principal concern, in this chapter, is the use of medicines by the physician; he discusses the administration of pharmaceutical and surgical cures, as well as chemical operations relevant to the preparation of medicines, such as grinding or trituration, calcination, putrefaction, maceration, clarification, filtration, and so forth, and the kinds of medicines that the chemist can concoct by these processes. In chemical operations described as diakrisis and synkrisis, Sennert tells us, bodies are broken down into small parts, and particles are, in turn, united. But Sennert distinguishes theory from prac-
tice, science from art. The former is identified with natural philosophy, the latter with physic or medicine and chemistry, which are practical fields that can provide evidence for the natural philosopher, but not theory. Sennert provides his early theoretical account of matter in his fundamental work on natural philosophy, first published in 1618 and many times thereafter, his *Epitome Naturalis Scientiae*.

Here we will consider two distinct versions of the *Epitome*, that of 1618, and a significantly revised edition, published in 1633. In both editions, Sennert presents an account of forms and prime matter that is consistent with TS1-TS3, noted above. Further, he consistently maintains that the elements, which are themselves composed of prime matter and a specific form, are the building blocks, i.e., the second matter, from which all other bodies come to be. But in comparing Sennert's discussion of the elements in these two editions of his *Epitome*, we find some striking textual changes.

So, for example, we find in both editions: “Galen, when defining an element to be the minimum part of that of which it is an element, himself adds [...]” This is followed in the 1618 text by the words: “a minimum is to be understood not as that which is a minimum in quantity and appears as such to sense, but as that which is first and simplest by nature and cannot be resolved into other different species.” In the 1633 text, Galen is portrayed as adding: “but it is not the same minimum that appears to the senses and that is in reality. For many things by their smallness escape the senses.” We find here a move from non-quantitative minima, (elements analyzed as the simplest substances, as not composed of or reducible to any other substance, a minimal grade of substance), to quantitative minima, which by their small size are not visible.

58 The 1618 edition is, with only slight stylistic changes, found in the Paris *Opera Omnia* of 1641 and in the 1632 Oxford edition (cited here as ENS). Cf. note 6.

59 The 1633 edition appears in the Lyons *Opera Omnia* of 1650, which will be cited here as E, O.

60 ENS, 192 (lib.3, cap 1): “Quapropter & Galenus ubi lib.1 de elem. c.1. Elementum definit esse minimum partem eius, cuius est Elementum, ipsemet addit; minimum intelligendum esse id, non quod Quantitate minimum est, sensuique talem appareat, sed quod primum ac simplicissimum natura est, & in alia specie diversa dissolvit non potest.”

61 E, O.1:49: “Quapropter [...] addit; minimum vero non idem & sensui videitur & vere est. Multa enim exiguitate sensum effugit.”
Further, in his discussion of the continuum and the infinite, Sennert considers whether or not the elements are divisible into smallest parts. In the 1618 edition, Sennert says of the elements, “a smallest cannot be assigned, [...]; so there cannot be any part of fire, than which there is not a smaller in the same fire.” Here he rejected real elemental atoms. But in his 1633 edition, in the same chapter, now entitled “On Quantity,” Sennert says instead, “the elements can be reduced to minimal particles, such that these bodies cannot naturally be divided into smaller ones than those which the Ancients called ‘atoms’ for that reason.” In this late edition, Sennert distinguishes mathematical from physical divisibility (in his Hypomnemata Physica, he claims that Aristotle errs by not noting this distinction), and he maintains that the elements are composed of atoms.

What’s more, Sennert, considering the vexing Aristotelian problem of whether the forms of the elements remain in the generation of a mixed body, says, in the 1618 edition:

We, rejecting others, will follow Averroes, who stated that not only the qualities but also the forms themselves of the elements remain in the mixed body, but refracted, so that one form comes to be from all, [...] just as from extreme colors and tastes there comes to be a middle, so those which were the grades of the forms of the elements now become mixed grades of form.

But this is replaced in 1633 by:

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62 ENS, 76: “[...] quo non potest dari minima quantitas in existens; cum omne continuum sit divisibile in infinitum; ita non potest dari ignis portio, qua non existat alia minor in eodem igne.”

63 E, O, 1:17: “[...] elementa [...] in minimas particulias rediguntur, ita ut in minores naturaliter, corpora amplius dividi non possint, quas propter e Antiqui Atomos appellarent.”

64 Cf. textual changes in Sennert’s Epitome, lib. 2, cap. 3, where, in his discussion of the element, fire, he adds a lengthy passage in which he speaks of “the atoms of fire” (“atomi igneae”; E, O, 1:43, 48). Cf. further emendations in lib. 3, cap. 3.

65 ENS, 215-16: “Nos, caeteris rejectis, Avenrois sequemur, qui statuit, non solum Qualitates, sed ipsas etiam formas Elementorum manere in misto; refractas tamen, ita, ut ex omnibus una forma fiat, [...] ut ex coloribus & saporibus extremis fiunt, medij; ita, ut qui fuerunt gradus formarum Elementorum, jam fiant gradus formae misti.”

66 E, O, 1:53-54: “Sed non levis hic oritur controversia quomodo Elementa maneant in mistis. [...] Nos caeteris rejectis Avicennam sequemur, cuius sententia plerisque Medicis doctrissimis approbatur, & Fernelio ita plana & firma videtur, ut lib. 2. Physiolog. Cap. 6, contrarium opinionem, puerele vereque inanem, imo portentosam appellaret. [...] Est autem Avicennae sententia, elementa non solum
We, rejecting others, will follow Avicenna, whose opinion is approved by many learned doctors [...]. It is however the opinion of Avicenna that the elements not only remain in the mixed, but also that they retain their forms perfectly and integrally. [...] And what Averroes and Zabarella assert of the refraction of forms is a pure figment [...].

These passages also reflect a change from a rejection to an endorsement of elemental atoms. Sennert explains: "In mixture the simples must first of all be divided into very small parts; so [...] they are more easily mixed. By the division of the elements thus into small parts, [...] they do by their contrary qualities mutually act upon each other and suffer from one another [...]." But, in his early view, these fragments are not enduring elemental atoms. The forms of the elemental particles blend to produce a single compound form. The result is that elements and homogeneous compounds, with one form throughout, are said to be continuous uniform bodies that just happen to break up into parts in substantial change. In 1633, Sennert claims instead that each elemental particle, in the generation of a compound body, persists and retains its own form (i.e., of earth, air, fire or water). So elemental atoms endure unchanged.

These textual changes raise the question of why Sennert moved from Zabarella's Averroist view to a theory in which compounds are composed of indivisible enduring elemental corpuscles. In Sennert's 1611 *Institutiones Medicinae* and in his other writings on chemistry, he could maintain, consistently with Zabarella's view, that inanimate substances (i.e., each body that has a single form) are homogeneous bodies that, in interacting, just happen to disintegrate into particles. From this Zabarellan viewpoint, when interacting elements are transformed to produce a single new substance, the elemental particles do not endure. But particles could actually remain (as Sennert claims they do) in mixtures that are composed of several compound substances, such as medicinal mixtures. So why did Sennert, unlike his Zabarellan colleagues...

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For Fernel's endorsement of Avicenna's view and for his objection to the Averroist view, see J. Fernel, *Ambiani universa medicina* (Paris, 1567), lib.2, cap.6, 55-6.

ENS, 218: "In mistione miscibilia primum in parvas & exiguas partes dividit, ideo [...] facilius miscentur. Facta sic in portiones exiguas, pro misti natura, Elementorum divisione, eadem per contrarias qualitates agunt, & patiuntur mutuo, se invicem calefaciunt, refrigerant, humidant, & exsuccant [...]."

In his 1619 writings on chemistry, Sennert appears to presume that par-
and in the face of a prevalent hostility towards atomism, come to adopt, in his *Hypomnemata Physica*, a thoroughgoing corpuscular matter theory, i.e., the view that all bodies are composed of atoms?

What changes in fact in the last two passages cited above is Sennert’s account of forms. In Zabarella’s view, forms can be altered, for the forms of the elements are ‘refracted’. In 1636, Sennert insists instead that his analysis of forms, presented in the first essay of his *Hypomnemata Physica*, entails that forms are immutable, and therefore he endorses enduring elemental atoms and Avicenna’s view. Further, another factor is at work. In his essay of his *Hypomnemata Physica* on the generation of living things, Sennert, claiming to correct Aristotle’s view, developed a more robust account of *specific forms* as structure-generating causes. This, in turn, led him to a more full-bodied view of matter, his atoms, as that which is organized or structured by forms. Sennert’s corpuscular matter theory was influenced by the evidence of chemistry,\(^69\) but, perhaps even more, by his distinctive view of forms. This view of forms will be considered in the following section.

3. Conceiving

In his account of matter, Sennert departed from Aristotle’s view in two modern directions: first, he maintained that space is a reality distinct from matter, that it is extended, penetrable, and, as the locus of motion, unmovable;\(^70\) and, second, he developed a corpuscular theory of matter. But this did not incline him to adopt a mechanistic world view nor to reject substantial forms. For Sennert, as for Aristotelians generally, matter and form serve a double role, as the principles of the constitution of natural bodies and as causes of their generation and corruption. As seen above, he agreed with his Zabarellan colleagues in providing a pluralis-

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\(^{70}\) E, O, 1:19-22. See also p. 24.
tic account of the constitution of natural substances. But, Sennert developed an account of the role of forms in generation that is at variance with the view of his Aristotelian contemporaries. In the previous section, we considered the development of his distinctive and innovative account of matter. In what follows, I will examine Sennert's account of generation and of forms.

In the hierarchical and pluralistic account presented in the *Hypomnemata Physica*, the soul of each living thing is its supervening specific form. Further, in inanimate things, Sennert claims, citing Scaliger, "that every form of every perfectly mixed body, although it is not a soul, as that of an adamant, is a fifth essence, far different from the four elements." Each compound substance is composed of hylomorphic particles as its matter and an ultimate specific form. The result is that the form of gold does not emerge from a blending of elemental forms but is really distinct from the forms of the elements. I would suggest that Sennert came to see over time that this change from his early Zabarella view of inanimate mixed forms was entailed, for consistency, by his analysis of souls (specific life forms) and their role in generation.

As a physician and professor of medicine, Sennert was concerned with biological generation, especially human embryology. We find in Sennert's *Hypomnemata Physica* that his correction of Aristotle's account of generation was a response, at least in part, to the long-standing problem Aristotelians had of providing an adequate account of embryology. Sennert followed instead a minority view, *viz.*, that seeds are alive (that parents transmit, at conception, a complete specific form or soul in the seed), so "a lion and the seed of a lion [...] have the same soul," a view hotly debated at the time. Sennert explains that peripatetics commonly see natural generation as analogous to artificial generation. Their claim is that a block of stone comes to be a statue when a

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71 *HP*, O, 1:166: "[...] omnem formam, cuiuscunque perfecte mixti, etsi non est anima, ut in adamant, naturam esse quintam, longe aliam a quatuor elementis."


73 Cf. e.g. F., Liceti, *De Ortu*. Sennert, E, O, 1:178, citing Liceti, says: "leonem ac semen leoninum esse univoca & habere eandem animam [...]." This was also the view of some Lutheran professors of natural philosophy. Cf. fn. 83.

74 *HP*, O, 1:143.
sculptor, with the last touch of his chisel, completes his work, and
the shape or form of the statue is in the stone. These Aristotelians
conclude that likewise the seminal matter that comes to be a liv-
ing cow, Bossy, must be shaped and sufficiently prepared before
a specific cow form or soul can arise in Bossy’s matter. Unicitists
and pluralists analyzed this process differently. But, Sennert con-
tends, the presupposition, common to both views, that a specific
form (a life form or specific soul) is generated when the forma-
tion of a substance is complete has problematic consequences.

The unicitist view that there can be only one substantial form
in a thing led many to adopt the embryological theory proposed
by Aquinas. A human fetus, says Aristotle, is first vegetative, then
sensitive, and finally rational. So, unicitists claim, if a thing can
have at most one substantial form, then in the development of a
human fetus, a vegetative form or soul is destroyed with the gen-
eration of a sensitive soul, and the sensitive form or soul is de-
estroyed when the rational soul, to permit human immortality, is
*created by God and infused in the body.*75 But pluralists from the
medieval period onward objected that a fetus as here portrayed
is a series of discontinuous substances, not a single substance; that
the role of human parents is underestimated and human hered-
ity is left unexplained; and that there is no rationale for the mys-
terious vanishing of substantial forms concomitant with the gen-
eration of a new form.76 However, Sennert also objected to the
pluralistic alternative, the view that, in the development of a liv-
ing thing, a series of substantial forms emerge and are super-
added to previous forms, until an ultimate completive form, the
specific form of the substance, is acquired.

In the ontology of all these Aristotelians, specific substantial
forms have a robust reality. It is a specific substantial form that
completely determines what a thing is. Cats and cabbages have
different kinds of bodies, because each is determined by a dif-

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75 For Sennert’s objection to this view of Aquinas, see HP, O, 1: 198. Sennert
objects to the common presumption, to explain human immortality, that the
human soul is created by God and infused in the body. He says that according
to these views the soul is infused only after the body has been formed: “Qui vero
creationem & infusionem animae statuunt, illi omnes non à prima conceptione
animam, sed postmodum corpori formato eam infundi existimant” (HP, O,
1:198). For his alternative account of immortality, see ibid., 199.

76 Cf. HP, O, 1:205: “Hoc enim modo foetus in utero non manebit idem
numero, sed alius erit, cum primis diebus nutrietur & augetur; alius, cum postea
uteretur sentiente; alius rursus, cum postea adveniret rationalis.”
different sort of specific form, a cat and cabbage soul, respectively. But the fact is that this specific form is not present in embryological development; it does not emerge until the structure that supports it is complete. In Sennert's view, this approach raises a double causal problem: first, what causes a particular bodily structure to develop in embryological generation?; and, second, what is the cause of a soul or specific form? (i.e., "a form that is in the matter that was not there before").

In response to his first query, Sennert, maintaining that Aristotelians commonly misread the analogy between artificial and natural generation, argues: As the generation of an artifact requires first an idea in an artisan's mind, and, based on this, the artisan's activity of shaping and building, the generation of any natural thing requires a prior organizing principle as the cause of its final structure. This cause cannot be simply Nature, as some say, for, Sennert responds, every specific effect requires a specific cause. Further, Sennert cites his observation of aborted embryos to show that growth begins immediately upon conception. But only a specific form, i.e., a soul, is a principle of growth and other vital activities. So, he concludes, a life form or soul must be present in a seed at conception.

In response to his second query, (i.e., what is the source of souls or specific forms), Sennert contends that a new form, which was not there before, cannot suddenly arise in matter, for, says Sennert, nothing comes from nothing. No better, Sennert argues, is Fernel's view that each soul is caused by the Heavens, for then generation is not univocal (parents are not the cause of their

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77 ENS, 47: "Cum enim ex nihilo nihil fiat naturaliter, forma vero in materia sit, quae antea non fuit, quaeritur unde eius sit origo?" For Sennert's objection to the unicitist account of generation of Toletus, see ENS, 47-50. In his HP, he also cites and opposes the views of generation of such unicitists as Suarez, Fonseca, Ruvius and others.

78 HP, O, 1:143.

79 HP, O, 1:200.

80 Sennert cites Albertus Magnus and Zabarella in support of his view. Albert postulates a formative virtue to explain generation, but Sennert rejects this, for a formative virtue and an educed specific form are an unnecessary duplication of entities. Sennert, citing Zabarella's statement that "animae vegetantis propriam esse conditionem, ut generans exhibeat aliquid de sua materia, atque aliquid de sua forma" (HP, O, 1:184), contends that Zabarella claims that, in human reproduction, the "vegetative" soul is transmitted with the seed (leaving sensitive and rational souls to arise over time). Zabarella's view is, in fact, ambiguous. Cf. Sennert's criticism, HP, O, 1:167.
Further, biological reproduction would not be generation but creation. Sennert contends instead that, since (as seen above) a soul must be present in a seed at conception, the embryo’s soul must be caused by the generator of the seed. He explains the logistics of this claim. First, each specific form is wholly in each part of the body, blood, bones, flesh and the like; so the soul of each parent is naturally in the seed of each parent. Next, in conception, the souls in the seeds of both parents join “as two flames united.” The result is one living seed with one new and independent soul. This leads Sennert to maintain:

For as artifacts are made by an actual agent, according to a determinate idea in the mind of the artist, and so not by any artist whatsoever, for a sculptor makes one sort of work, a box-maker makes another kind, a carpenter another; so also for the generation of any natural thing, a determinate and specific agent is required, and one that is an actual agent, which, according to the power granted to it by its creator (just as the artist proceeds according to the idea that he conceived in his mind) makes a work like itself. In this only is there a difference, that in the case of artifacts, the artist is outside the matter; in natural things the artist is in the matter, and diffused through the matter.

The upshot of this is that, in living things, specific forms, transmitted with a seed, determine, in accordance with the Divine Designer’s plan, what comes to be; each specific form functions as an internal efficient cause. And so, Sennert explains, the Divine plan unfolds, for God created all things, so God created, along with and in appropriate matter, all forms, and God said “Be fruitful and multiply.” Beginning in the late sixteenth century, this divine “benediction” was taken by Lutherans at, for example, Strasbourg and Wittenberg to require, as Lutheran dogma, that the human soul was created by God in Adam, and after that, was transmitted in the seed, i.e. by traduction. This then hotly debat-
ed Lutheran doctrine is possibly the basic motivation for Sennert's zeal in pressing his solution to the Aristotelian problem of generation. So Sennert, in response to his second query, adds to his fundamental theses his distinctive doctrine of the origin of forms:

TS4: God, at Creation, created all forms.
TS5: Specific forms multiply themselves in matter.

Sennert correctly sees that embryological development requires an organizing principle. In his view, a specific form or soul, transmitted by parents, exists complete and whole in each seed, as, in his words, a *principium plasticum* (a formative principle). But then the matter organized by this formative principle must be building blocks that can be structured.

From this viewpoint, in the embryological development of Bossy, the specific cow form (which uses, as its material instrument, a fifth element, identified by Sennert as an architectonic spirit), regulates what the seed takes in as food. Then these food particles, interacting with those in the seed, undergo chemical processes of separation and combination, to form appropriate new complex atoms of Bossy's body, each endowed with Bossy's specific cow form. Furthermore, Sennert takes biological generation as the model for the generation of all substances. But gems and metals, Sennert insists, do not multiply themselves by seeds. Instead, a specific form that was created by God along with architectonic spirits in the earth multiplies itself by regulating, over time, chemical changes in a vein in the earth *per minima.*

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84 Sennert maintains that "innate heat" is transmitted with the seed, not as a quality *simpliciter* as was the common view, but rather as a quality, which, like all qualities, "flows from a form," in this case, from the form of spirits transmitted with the seed. Sennert's architectonic spirits are a subtler fifth element used by the soul to break up and to bond together crass atoms.

85 Sennert says, HP, O, 1:184: "I am not so stupid and foolish that I believe this loadstone, this diamond, this crystal, this gold [...] generates another loadstone, diamond, crystal, gold, as one poppy generates another poppy, and one lettuce generates another lettuce." ("Neque enim tam bardus & stultus sum, ut credam, hunc magnetem, hunc adamantem, hanc crystallum, hoc aurum [...] alium magnetem, adamantem, crystallum, aurum generare, sicut papaver aliud papaver, lactuca aliam lactuacan generat").

86 Sennert believed, from numerous eyewitness reports, that gems and metals
A basic rationale for Sennert’s forms was their role in embryology, and this promoted his commitment to specific forms of compound bodies that are really distinct from elemental forms. But this is only part of the story of Sennert’s forms. Sennert’s consistent theme and fundamental project from his earliest to his last writings was to shift *specific* forms from the end of generation to its outset, from “compleviev” principles to initial organizing principles. Indeed, as early as 1600, in his first publication, Sennert adopted TS4 and TS5 in relation to the forms of living things, and he developed and extended this view over time to apply to inanimate substances as well. This departure from Aristotle’s account of generation is no trivial correction of what Aristotle said; it in fact represents a major shift in perspective, a reconception of the Aristotelian world view. In Sennert’s new world order, God as world maker, commands that the Idea of the universe conceived in His Mind must be constructed by specific forms, which are His agents in the world. God Himself acts on things only once, at creation. Specific forms work God’s will in the universe. So Sennert says:

Without doubt, if Aristotle had recognized and understood the first and true origin of forms, and the creation of the world, as we know it, he would have left us a much more coherent and better natural philosophy [...]. We, grow in the earth, and he sought to explain this phenomenon. On like grounds, he accepted the transmutation of metals, but says of transmutation (ENS, 402): "the transmutation of metals is not simply artificial [...]. Nor does the art proceed from any other principles than merely natural ones, but those things that nature has generated, she mixes together in a certain way." ("Non artificialem esse simpliciter metallorum transmutationem [...]. Neque ex aliis principiis, quam merè naturalibus ars procedit, sed ea, quae natura generavit, certo modo miscet"). For a discussion of Sennert’s view of the transmutation of metals, see Ch. Meinel, “Early Seventeenth-Century Atomism,” 95-96.

87 See Sennert, Disputation III, thesis 42. In his HP, Sennert cites Scaliger and Thomas Erastus in support of TS4 and TS5.

88 ENS, 50-51. "[P]rocul dubio Aristoteles, si veram & primam formarum originem, ita ut nos novimus, & mundi creationem cognitam perspectamque habuisset, in multis concinniorem melioremque Physicam nobis reliquisset. Nos ergò, quibus haec ex S. Literis cognita sunt, [...] statuamus. Formas ipsas, ut & materiam, in prima mundi origine, cum rebus ipsis creatas esse, ut ex ipsis res omnes naturales constarent. [...] Per formas non solum res omnes naturales pro sua natura, hoc est, ut ipsis à Creatore praeceptum est agere, sed & per eadem regi, conservari, propagari. Iussit enim Deus, ut res naturales non solum per suas formas existerent, sed etiam per eadem sese propagarent; & dum iussit, vim simul tribuit singulis, quâ quod iussa essent perficerent, [...] Creatoris ergò iussui res naturales obtemperant, formaeque omnes vi in primacreatione sibi indita gignunt sui promotione & propagione [...]."
to whom these things are known from the Sacred Scriptures, state therefore that forms themselves, as also matter, were created at the beginning of the world with the things themselves, that of them all natural things might consist. [...] By forms not only do all natural things act according to their nature, that is, as has been established by the creator, but they are also thereby governed, preserved and propagated. For God commanded that natural things should not only exist by their forms, but also propagate themselves by these, and when he commanded this, he at the same time gave to each of them the power to do what had been commanded. [...] Therefore, natural things obey the command of the creator, and all forms, by a power with which they were endowed in the first creation, generate by promotion and propagation of themselves.

From this viewpoint, Sennert concludes that if the whole world is viewed as a single body, its form is not a World Soul, as the Platonists propose, a hypothesis that he argues is unnecessary, absurd, and inconsistent. The form of the world, instead, as the Aristotelians correctly claim, is its orderly structure. But the Aristotelians also err. Sennert contends that the form of the world, the cosmic structure, is not a product of dispositions in matter towards completion; it is not the result of final ends functioning as causes, as in Aristotle's eternal uncreated world. The cause of the world's orderly structure is God's creation of forms. Sennert's response to his double causal problem, along with his theological commitments, inspired a new view of the causal structure of the world. All natural causation is by specific efficient causes, viz. specific forms, which multiply themselves in matter by organizing atoms to actualize God's providential plan. This view, assuming TS4 and TS5, is surely not mechanism, but it is again a halfway house between the old and the new, between Aristotelian causation presuming forms as ends and the modern conception of causation by structures of atoms, which function as specific efficient causes.

To conclude, Daniel Sennert, very early in the seventeenth century, before the publications of Descartes and Gassendi, developed

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89 ENS, 28-29. N. Emerton's otherwise excellent study (The Scientific Reinterpretation of Form, Ithaca, 1984, 64-5) is here misguided, for she mistakes Sennert's explanation of views supporting a Platonic world soul for an endorsement of this doctrine. Cf. also, HP, O, 1:213: "Verum enimvero animam mundi nullam dari, alibi satis demonstratum. Licet enim in animalibus ab una anima variae actiones proficiantur; tamen mundum eodem modo esse unum quo animal aliquod unum est, nondum probatum." "But in fact it is elsewhere sufficiently demonstrated that there is no world soul. For though in animals various actions proceed from one soul; yet it is not proven that the world is one in the same way in which an animal is one."
a hierarchical atomistic theory, presuming atoms and grades of molecules. Sennert’s atomism is especially interesting because, unlike later atomists, he did not reject Aristotelianism. In fact, Sennert’s atomistic theory developed over time from the foundation of a distinctive Aristotelian tradition, viz., Latin pluralism. Sennert, in his early writings, accepting the Zabarellan analysis common among his Wittenberg colleagues, seems to presume quasi-atoms, i.e., elemental particles that are divisible and that can blend and be transformed to produce a homogeneous compound substance. But Sennert, in his late view, claims that the elemental atoms are indivisible and immutable, the smallest natural bodies, and the building blocks of all other things. I have here argued that Sennert’s change was motivated, not simply by the ancient atomism of Democritus, nor simply by the evidence of chemistry, both of which he draws upon to justify his later atomistic views. Instead, surprisingly enough, Sennert’s final corpuscular theory of matter was prompted, perhaps most acutely, by the requirements of his distinctive account of forms. These considerations have led me to conclude that Sennert, a prolific, prominent and extremely influential writer in his time, though now largely neglected, is in fact of great interest as an archetypical transitional figure, not simply because of the theories he proposed, but also (in the light of lessons to be learned from history), as an invaluable resource for understanding the problems, perspectives, and strategies influencing the rise and the development of modern science.

**Abstract**

Daniel Sennert (1572-1637), a prominent physician and a prolific and influential writer, was both an atomist and an Aristotelian. He was influenced by a distinctive and now little known Aristotelian approach to matter and form, and this promoted his development over time of a hierarchical account of atoms, with elementary atoms and grades of molecules. The first section provides a study of Sennert’s Aristotelian foundation. The final two sections consider, in turn, Sennert’s development over time of an atomistic theory, and the nature and significance for him of substantial forms.
64 **The Couvade: A Psychological Analysis**
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