

82. Cfr. SS 316 (II 446 SEH): "Experiments in consort touching maturation, and the accelerating thereof. And first, touching the maturation and quickening of drinks. And next, touching the maturation of fruits": "As for the maturation of fruits, it is wrought by the calling forth of the spirits of the body outward, and so spreading them more smoothly: and likewise by digesting in some degree the grosser parts; and this is effected by heat; motion; attraction; and by a rudiment of putrefaction; for the inception of putrefaction hath in it a maturation".
83. SS II 475 SEH ("Experiments in consort touching the acceleration of germination"): "We will now inquire of plants or vegetables, and we shall do it with diligence. They are the principal part of the third day's work. They are the first product, which is the word of animation; for the other words are but the words of essence. And they are of excellent and general use for food, medicine, and a number of medicinal arts". In generale cfr. SS 401-412 (II 475-479 SEH).
84. Cfr. la conclusione in SS 411 (II 478-479 SEH): "It seemeth by these instances of water, that for nourishment the water is almost all in all, and that the earth doth but keep the plant upright, and save it from overheate and over-cold; and therefore is a comfortable experiment for good drinkers. It proveth also that our former opinion; that drink incorporate with flesh or roots (as in capon-beer, etc.) will nourish more easily than meat and drink taken severally".
85. SS 405 (II 477 SEH): "The former means of helping Termination, are either by the goodness and strength of the nourishment; or by the comforting and exciting the spirits in the plant, to draw the nourishment better ..."; SS 406: "Besides the two means of accelerating germination formerly described; that is to say, the mending of the nourishment, and comforting of the spirit of the plant; there is a third; which is the making way for the easy coming to the nourishment and drawing it ...".
86. SS 413 (II 479 SEH: "Experiments in consort touching the putting back or retardation of germination"); in generale cfr. SS 413-421.
87. *Ibid.*
88. SS 445 (II 485 SEH: "Experiments in consort touching the melioration of fruits, trees, and plants"); cfr. HVM 131 §3 SEH.
89. SS 461 (II 488 SEH); cfr. anche SS 458 (II 488 SEH), SS 473 (II 491 SEH).
90. SS 510 (II 504 SEH: "Experiments in consort touching curiosities about fruits and plants").
91. SS 563 (II 516: "Experiments in consort touching the producing of perfect plants without seeds"); cfr. anche, nella medesima sezione, SS 564-573.
92. NO Lib. I Aph. III (I 158 SEH).

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Articoli/Articles

PARTICLES OF THE SOUL.  
THE MEDICAL AND LUTHERAN CONTEXT  
OF DANIEL SENNERT'S ATOMISM

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SUMMARY

*Daniel Sennert was a well-known and influential representative of early 17<sup>th</sup>-century atomism. He used Aristotelian hylomorphic terminology to put forward radical new ideas on the relationship between matter and soul. His belief in a mere multiplication of preexistent forms/souls since the Creation and in a coexistence of dominant and subordinate forms in natural things led him to the notion of atoms of the soul which via semen could transfer the human soul from one generation to the next. Focussing on the professional and cultural context of Sennert's theory rather than on its retrospective importance in the history of chemistry, this paper argues that it was a largely medical framework from which Sennert developed these ideas, and it stresses Sennert's strong Lutheran allegiances as a major driving force, especially behind his atomist traducianism, i. e. his claim that the human soul was propagated per traducem in tiny particles of matter rather than merely being infused days or weeks after conception, as Catholics and Calvinists alike asserted.*

*Introduction\**

The rise of atomism in the early 17<sup>th</sup> century has long been considered a major characteristic as well as a driving force of the 'scientific revolution', as a milestone on the road to modern science<sup>1</sup>. But, as various studies have shown in the meantime, the rise of atomism cannot simply be taken as a largely inevitable result of 'scientific progress'. On closer analysis, the empirical basis of early modern atomism was in fact rather shaky

*Key words:* Atomism – Theology - Traducianism

and its explanatory powers were limited in comparison to conventional Aristotelian physics. It was thus by no means due to mere backwardness that many contemporary scholars rejected atomism<sup>2</sup>. Historians have also become more aware that early modern atomism was far from uniform, indeed, that atomism underwent a process of growing pluralization in this period. Neoatomists referred to Democritus, Epicure and Lucretius<sup>3</sup>, but they used their authority to legitimize a wide range of different and often conflicting interpretations<sup>4</sup>.

The methodological implications for the historical analysis of early modern atomism are as obvious as they are far-reaching. The mere fact that an early modern scholar was acquainted with atomistic concepts does not explain why he accepted them. Instead, the reasons why certain early modern scholars – unlike many others – preferred and developed atomism, must be identified much more precisely. And, what is more, since early modern atomism was so heterogeneous, these reasons are likely to be quite different from scholar to scholar. This means that we have to historicize and contextualize the various conceptions of early modern atomism and the driving forces behind them on a case to case basis, paying close attention to the kind of atomism proffered as well as to the respective philosophical, cultural, scientific, religious and political contexts which might have occasioned or at least promoted that particular choice.

In this sense, this paper will focus on the driving forces behind the ideas of one of the best-known representatives of early 17<sup>th</sup>-century atomism, Daniel Sennert (1572 -1637). Although widely read and highly influential throughout Europe, Sennert was not quite as instrumental in the 'revival' of atomism as Laßwitz and others have claimed<sup>5</sup>. A number of early 17<sup>th</sup>-century scholars, and, for all we know, often independently of each other, played with atomist ideas at that time. Atomism was 'in the air'<sup>6</sup>. But Sennert's was one of the most radical and elaborate attempts to apply atomism to living, animate beings. He attributed specific vital, animate properties and virtues to the atoms - including atoms of the human soul<sup>7</sup>. As I will argue, Sennert's atomism was profoundly shaped by the occupational and cultural-religious context in which he moved

or, to put it more precisely, by his medical profession and his Lutheran faith. It has aptly been remarked that most protagonists of early 17<sup>th</sup>-century atomism were physicians or Protestants and often both, but the medical and religious ramifications of early modern atomism have only just begun to be explored<sup>8</sup>.

### 1. The principles of Sennert's atomism

The basic principles of Sennert's atomism can be found in their most detailed and elaborate form in his last work, the *Hypomnemata physica*<sup>9</sup>. Sennert's atoms are not those of Democritus and Epicure. They are not primarily distinguished by size and shape, and they do not form larger entities by mere fortuitous encounter and aggregation. They are above all the carriers of specific forms, to which they owe their respective qualities and virtues. With the exception of man's soul after death, the forms of natural things are inextricably bound up with their matter. But Sennert basically reverses the relationship traditionally held to reign between the two. According to Sennert, the form predates the process of mixture<sup>10</sup>. Form does not emerge from the specific mixture of elementary matter, as the Aristotelian concept of an "*eductio formarum ex potentia materiae*" would have it. The forms of natural things have always been there, from the beginning of Creation, and they have informed new matter simply by multiplication ever since. Form itself is an active, dynamic, semen-like principle, which changes and structures its substrate matter according to its needs. It is the "*architect of its own domicile*", as Sennert puts it. The traditional Aristotelian distinction between 'in potentia' and 'in actu' thus becomes largely obsolete: as seminal principles and agents, forms are always 'in actu'. If they remain inefficient this is only due to a lack of adequate instruments or adequate matter.

Atoms conglomerate into larger bodies not thanks to their fortuitous encounter but either on the basis of their respective sympathies or due to the rule of a superior, dominant form. As to the former, Sennert attributes a certain natural appetite and a certain cognition to natural things - distinct from rational

sense - which causes inanimate as well as animate things to be specifically attracted to some things and to be repelled by others<sup>11</sup>, such as when atoms of water or mercury gather together to form larger droplets. Similarly, Sennert felt, the visible ebullition in certain chemical reactions was probably not just due to the mutual (re)action of contraries but also to the motion of like towards like<sup>12</sup>. More complex structures, on the other hand, were the work of a dominant form or soul which informed the subservient matter according to its needs.

Sennert sketches a roughly three-tiered hierarchy of atoms which frequently coexist in complex natural things. This hierarchy of atoms corresponds to a plurality and hierarchy of forms<sup>13</sup>. Numerous forms can coexist in one thing or body but only one dominant, essential form rules. In living, animate beings this is the soul. The subordinate, lower forms, each with their corresponding corpuscular matter and each endowed with their peculiar qualities and virtues, are preserved integrally - not just refracted, as Sennert had at first assumed with the Averrhoists - under the rule of the dominant form. Only elementary atoms are indivisible in an absolute, physical sense, at least according to the position Sennert took in his later work<sup>14</sup>. They cannot be further divided into smaller particles. Higher-level atoms can, in principle, be further divided, but in this case the particles can no longer bear and support the respective superior form, with its specific qualities and virtues. The dominant form perishes, when its peculiar substrate matter is divided or reduced to the point that it can no longer support it. Instead the hitherto subordinate forms now become dominant. With the exception of elementary atoms, Sennert's atoms thus are *minima* of form rather than physical *minima* in a mechanical sense. Just as light, according to Sennert<sup>15</sup>, cannot be dimmed indefinitely, but is totally extinguished below a certain threshold, forms - including souls - need a certain amount of suitable matter to support them. Otherwise they perish and the thing or animal they inform dissolves into various kinds of lower level atoms, each with their own form.

On a first level of his hierarchy, Sennert posits the atoms of water, earth, fire and air. They are endowed with the primary qualities cold, warm, moist and dry. Their local motion - rather

than the interaction of primary qualities - explains a range of simple chemical and physical changes in nature. Water on a stove gets hot not because the hot acts on the cold, but due to the addition of fiery atoms to the atoms of water. When it evaporates, water does not turn into air; its atoms are only spread over a larger space and turn back into water when they come together again. On a second level, we find the elements of the "*prima mista*", the compounds. They exhibit the manifold qualities and virtues which conventional Aristotelians associated with the *complexio* emerging from the interaction of primary qualities. But in Sennert's account they owe these qualities to the specific form which predates the mixture and produces and governs it. These secondary atoms are the constituents to which many more complex things and bodies in nature are reduced in (al)chemical analysis or in processes like fermentation and digestion. Finally, on the third, uppermost level, Sennert places the atoms of animate beings, some of which even carry a complete soul. These animate atoms are of crucial importance for Sennert's explanation of the two major themes to which he devotes more than two thirds of the *Hypomnemata*'s pages: spontaneous generation and human propagation<sup>16</sup>.

Sennert shares the then widely held belief in spontaneous generation. He holds it to be less common, however, than usually assumed. Frequently, he claims, tiny seminal corpuscles of the future worms, insects or the like found access to the putrefying matter, without anyone noticing it. In these cases therefore the generation was not 'spontaneous' at all. In other cases, no seminal matter came in from the outside. Instead, a special kind of informed or ensouled matter within the decaying plant or animal took over, which had been subordinate to the dominant form, the soul of the plant or animal. In this sense, the form of the future, 'spontaneously' generated worm had already been 'in actu' during the plant's or animal's life-time, but it could not organise its matter according to its own needs and was subservient to the dominant form<sup>17</sup>.

Finally, in his treatment of the propagation of the human soul, Sennert makes a clean break with traditional mainstream philosophy. Usually, the human soul, i. e. the rational soul which

gave man his essence, was thought to enter the embryo only several weeks after conception, after 40, 80 or even 90 days. When the embryo was suitably prepared to receive it, God created the soul and 'infused' it into the body. This made abortion before that time a less serious crime than afterwards<sup>18</sup>. Sennert's account was radically different<sup>19</sup>. He advocated a traducianist interpretation. The rational soul was already present in the semen and was *in actu*. From the very start, the embryo was a human being, endowed with a rational soul. For, as he already stated in a 1609 dissertation, it was the rational soul to which man owed his essence and which was responsible for the vivification and differentiation of the seminal matter into the embryo and its envelopes<sup>20</sup>. He rejected alternatives such as an intermediate 'seminal force'<sup>21</sup> or the initial rule of the vegetative or animal soul until the rational soul entered<sup>22</sup>. The ultimate source of the human soul was the same as that of all other forms. It was not created anew. It had existed since the creation and was propagated "*per traducem*" from the parents to their offspring. In conception, the male and the female seed joined to form one soul, just as the flames of two candles could merge to kindle a third candle with their own light without any loss<sup>23</sup>.

### 2. The medical and religious context

The general principles of Sennert's atomism are fairly well known and have been frequently described. Few scholars would still erroneously interpret his theory in terms of a mechanical philosophy. The context of and the driving forces behind Sennert's ideas, however, are far from clear. Historians have arrived at rather divergent conclusions, depending also on the discipline, the history of which they were studying. Most studies so far have focused on the place of Sennert's atomism in the history of chemistry. They have rightly pointed to Sennert's use of atomistic concepts to explain various chemical phenomena and procedures where tiny particles of a specific substance remain intact and can be recovered in their original state<sup>24</sup>. Sennert was undoubtedly an important figure in the history of chemistry. Clearly Sennert found atomism a useful device for explaining certain physical and chemical processes. But if we look at Sen-

nert's theory as a whole and the use he actually makes of atomism, it also becomes clear that Sennert's interest in chemistry is only part of the story. His fullest and most elaborate account of atomism is in the *Hypomnemata*, a work which deals with chemistry only marginally. Indeed, as I shall endeavour to show in this paper, there were other – and probably more decisive – driving forces behind Sennert's peculiar brand of atomism. Sennert's atomism was a useful complement to his new understanding of matter, form and soul and thus also to a substantial degree reflected the general professional and cultural context in which he lived and worked, namely, his medical profession and his Lutheran faith.<sup>25</sup>

### 3. Medicine

In his working life as a university professor and as a professional man, Sennert was, above all, a medical man, a physician. The bulk of his writings dealt with medical topics, and his European fame rested on his medical works, above all on his *Institutions of medicine*<sup>26</sup> and his *Practical medicine*<sup>27</sup>. These works appeared in numerous editions as well as in various digests and translations, and they were still widely quoted in the 18th century. Like most physicians of his time, Sennert started out as an arts student and received solid training in natural philosophy, in Wittenberg. Apparently he even taught on the subject himself once he had received his master's degree. His first major publication was a series of 26 disputations on Aristotelian natural philosophy, which he wrote and presided over in 1599/1600 and which were to form the basis of his later *Epitome naturalis scientiae* of 1618<sup>28</sup>. But atomistic concepts hardly play any role at all in this work. As Christoph Lüthy and William Newman have shown, Sennert uses the term 'atom' only twice in these disputations: once to refute the Democritan idea that things in nature resulted from a mere chance encounter of atoms. And once in a totally different context, when he describes the non-dimensional presence of God in all things of the world<sup>29</sup>.

Sennert developed his atomistic concepts only in the course of his highly successful medical career<sup>30</sup>. In his *Institutions of medicine* of 1611, as William Newman has shown, Sennert already

refers to the Democritan (but also Aristotelian) concepts of 'diacrisis' and 'syncrisis' and repeatedly quotes (Pseudo)Geber in a section dealing with the preparation of drugs, but ultimately corpuscularian concepts still only play a very marginal role. In *De chymicorum cum aristotelicis et galenicis consensu et dissensu* of 1619, his major work on Paracelsian medicine and chemical philosophy, atomism is explicitly supported, but still plays no major part<sup>31</sup>. Only much later and above all in his later more detailed analysis of the specific properties and virtues of plants, animals and men and of the propagation of forms and souls in the *Hypomnemata*, did he present his atomist theory in a more detailed and elaborate form.

So how did the concept of the tiniest atoms (or minimal corpuscles) endowed with specific forms and corresponding specific, often supra-elementary qualities and powers, come to acquire increasing importance in the course of Sennert's medical career? Sennert's starting point was, it seems to me, his wish to do justice to the awe-inspiring variety of things, forms, properties and virtues of Creation in general and of the human body and the medicinal plants and substances which were used to cure it in particular. The basic axiom of his medicine and philosophy was not atomism but anti-reductionism. As he kept stressing, there was "hardly anything more harmful" in natural philosophy and no greater source of futile endeavour than the attempt to "attribute everything that happens in natural things to the manifest qualities and the four elements"<sup>32</sup>. Again and again he underlined instead the special and often unique qualities and powers of natural things and turned against those who resorted to the manifest qualities and an "eductio e potentia materiae" in order to explain the "unlimited treasures of divine wisdom", the admirable complexity found even in lice and other most humble creatures<sup>33</sup>. But he also rejected the theory of scholars like Fernel and Jessenius, who assumed a supernatural, celestial origin of the forms, such as the "colchodea", the heavenly giver of forms of Avicenna<sup>34</sup>. Instead, Sennert drew on the Bible as his decisive source which, in his eyes, guaranteed the superiority of Christian philosophy. The Bible, according to Sennert, taught that all forms with their qualities and powers had been created

by God at the beginning of time. After Creation, there was thus no need for any further creation, generation or influx of new forms. For the forms were already there. They were seminal principles endowed with the ability to multiply thereafter without any loss of substance, just like the flame of a candle could light another candle without any loss to itself.

Sennert found support for his particular notion of forms and particles in the medical theory and practice of his time. Sennert may have become familiar with atomism and the theory of minima through his teacher Jessenius<sup>35</sup>, through Giordano Bruno<sup>36</sup>, or through the alchemical writings of Pseudo-Geber<sup>37</sup>. But in an age, when most philosophers and physicians had already at least heard about atomism, it was much more important, especially for an ultimately rather cautious scholar like Sennert, that atomism also had the support of some of the most eminent authorities of all times<sup>38</sup>. Avicenna, in particular, in a well known passage on the nature of the "complexio" or "temperament" was quoted in this respect by Sennert himself as well as by his favourite authority, Scaliger. For the "complexio", according to Avicenna, was the "quality which results from the mutual action and passion of the contrary qualities of the elements whose parts are reduced to the smallest [ad minimas] so that they touch each other the most"<sup>39</sup>. Medical writers before Sennert had also already found the notion of minuscule particles a useful explanatory device when it came to understanding the many specific, occult qualities and virtues which remained fully efficient in minuscule and sometimes invisible quantities and matters. In his account of the manifold effects of semen on the (male) body, Galen himself had already underlined the powers of tiny particles of certain substances to penetrate and alter the whole body<sup>40</sup>. Similarly, Sennert quoted Galen's association of contagious diseases with tiny, invisible, semen-like matter<sup>41</sup>. Fracastoro, in turn, had confirmed and elaborated on this concept with the help of Lucretius' concept of "semina" and combined it with the notion of sympathy to explain contagion across space, without immediate contact<sup>42</sup>.

On a more empirical level, a belief in tiny particles of matter which fully retained their forms and supraelementary powers

was, from Sennert's anti-reductionist point of view, also useful for the understanding of a range of medical phenomena which were hard to explain as a mere result of an interaction of elementary qualities. The hole at the end of a scorpion's tail, for instance, was imperceptible, and yet the tiny quantity of poison that came out of it could kill a man. In therapy, especially in the case of diseases of the "*total substance*", tiny quantities of alexipharmaca and similar specific drugs were found to be sufficient to cure a big man<sup>43</sup>. Substances could also be dissolved until they were no longer visible and migrate through the body, retaining their original form and qualities. Kidney and bladder stones, for example, as Sennert underlined already in 1608, or the typical hard deposits around the joints of gout patients, were analogous to the development of rocky accretions in thermal stations, an example repeatedly referred to by Sennert<sup>44</sup>. In both cases tiny, invisible particles of matter were dissolved in the water or body fluid, which seemed to be totally clear<sup>45</sup>. Due to their particular sympathy they then congregated again in suitable places, forming larger, visible and palpable concretions. Likewise, when the mother ate or drank tiny particles of medicine or food-stuffs endowed with a specific purgative power, the suckling infant suffered from diarrhoea, even though the maternal milk appeared perfectly clean. A most amazing concentration of manifold supraelementary powers in tiny quantities of matter finally could be observed in the propagation of plants, animals and humans. Small amounts of seed or semen were enough to produce a whole new plant, animal or man with its various parts and manifold properties and powers.

In more concretely medico-scientific terms, Sennert's account owed its plausibility and legitimacy first of all to the well-established concept of 'specific' or 'occult' qualities. It was based on the belief that many qualities and powers in natural things could not be shown or proven by rational argument but could only be assumed on the basis of their observable effects. The faculty of the loadstone to attract iron, the power of the eche-neis to stop large ships, or the electric shock generated by the torpedo fish were popular examples, which Sennert frequently quoted<sup>46</sup>. More generally, the manifold sympathies and antipathies among

natural things served as a paradigm for occult qualities, especially when they seemed to act across larger distances. To the physician the specific attraction between certain drugs and certain parts of the body or certain humours was particularly crucial. Experience showed, for instance, that certain purgatives were able to specifically attract a particular kind of peccant humour rather than indiscriminately depleting the body of its fluids<sup>47</sup>, which clearly indicated a particular sympathy between the two. Other conspicuous though more controversial examples were 'magnetic' cures which acted at a distance and without any immediate contact with the sick body, like the so-called weapon salve. While critics maintained that 'magnetic' cures could only be diabolical magic, Sennert sided with those who thought that sympathy sometimes at least provided a perfectly natural explanation for action across space<sup>48</sup>.

As a physician, Sennert was also well acquainted with the related notion of diseases of the 'total substance'. Galen had only mentioned the concept, but Jean Fernel, in particular, had made it popular among physicians - like that of the 'occult qualities'<sup>49</sup>. Diseases of the 'total substance' were diseases usually characterised by particularly complex or strange and often highly dramatic symptoms or bodily changes. These symptoms, it was thought, could not be caused simply by the various humours and their qualities. They indicated that the 'total substance' was affected, giving the disease a peculiar, 'specific' nature. They had to be treated by 'specific' medicines, which acted, in turn, through their 'total substance'. Sennert became familiar with these concepts very early. In 1596, when he was still an arts student, he defended a disputation which his teacher and mentor<sup>50</sup> Johann Jessenius von Jessen had written about diseases of the 'total substance' resulting from the outside air. In 1599, he responded to a second thesis by Jessen on the causes of the sympathies and antipathies among natural things<sup>51</sup>. Many sympathies and antipathies, according to Jessenius, resulted from manifest, primary qualities. Melancholics, for example, with their cold and dry temper, abhorred sanguine, i. e. warm and moist, animals. Other sympathies and antipathies, however, could neither be attributed to the primary qualities nor to the

soul. Such qualities and powers, Jessenius believed, were ultimately due to a supernatural 'influx' from the heavenly bodies. In his first medical publication, the *Quaestiones* of 1607, Sennert, in turn, discussed Fernel's concept of 'total substance'<sup>52</sup>. A year later, in a disputation of 1608, he dealt with the *morbis gallicus* and plague fevers as examples of diseases in which occult and specific rather than elementary qualities were at issue and which, in turn, called for drugs which did not cure through their manifest, primary qualities, but thanks to a specific property of their 'total substance'<sup>53</sup>.

Sennert further developed these ideas in his discussion of the 'innate heat' or *calidum innatum* which was to play a particularly important role in his concept of a three-tiered hierarchy of dominant and subordinate forms<sup>54</sup>. Most contemporary drugs derived from plants or animals, i. e. from living matter. However, at the time when they were used, they were dead and sometimes had been dead for years already, e. g. in the case of dried plants. Therefore, by definition, they no longer had a soul which could be held responsible for their specific, curative effects on man or animals, but Sennert also refused to accept these effects as a result of their primary qualities. They therefore had to be due to a formerly subordinate form which came to dominate the plant or animal (or the medicinal parts of it) when the plant or animal soul itself perished. This now ruling form and its specific supraelementary matter was equated by Sennert, in particular, with the 'innate heat', which, in higher animals and man, according to traditional medical theory, was concentrated in the heart whence it spread to the rest of the body as 'spirit'<sup>55</sup>. More than many of his predecessors - but still fully in line with Avicenna's account - Sennert stressed the ultimately spiritual nature of the 'innate heat' itself. This allowed him to quote Aristotle as his authority, who had attributed a quasi-ethereal, celestial, quintessential nature to the spirit. He also claimed that at least a similar supraelementary 'spiritual' substance was responsible for the specific properties and powers of gems, stones and minerals. And he used alchemical experience with distillation and similar processes as empirical evidence that the 'spiritual' quintessential matter, i. e. the actual drug with its powerful

effects, could be separated from the rest of the plant or animal which lacked these powers<sup>56</sup>.

#### 4. Religion

At various points, the religious connotations of Sennert's theory have already surfaced. Sennert's praise of the biblical account as a superior source of truth was above all a critique of the 'pagan' Aristotle and his concept of an eternal, non-created world. But in certain respects his notion of a creation of all forms at the beginning of time, called not only for a Christian Creator-God, but more specifically for a Lutheran God. Sennert's concept of a propagation of specific forms (and souls) with their given qualities and powers also served to reject rival Catholic and Protestant notions of a more intervening and controlling God who continued to constantly tamper with his creation. According to Sennert God only intervened in miracles and these were, by definition, rare. Once God had created the specific forms of all natural things and subjected them to the laws of his creation, Nature would run its own course and the forms - including the human soul - could propagate and multiply without any need for further divine support or interference. Sennert's God, like that of most contemporary Lutheran theologians, literally rested after the sixth day<sup>57</sup>.

The paramount role of supraelementary forms in medicinal plants and, more generally, Sennert's focus on the specific and largely occult qualities of compounds and animate beings, had important epistemological implications: it called for an explicitly empirical approach<sup>58</sup>. Since the manifold properties and virtues of natural things - and their medicinal properties in particular - were due to the respective form which God had given to them in creation, true knowledge of nature could not be acquired from the knowledge of the general laws, but only from empirical evidence<sup>59</sup>. The stressing of empirical evidence was characteristic of many 'modern', innovative approaches in 16<sup>th</sup>- and 17<sup>th</sup>-century medicine but, once more, some religious, confessional connotations can also be detected. Personal observation (or that of reliable, trustworthy witnesses), the detailed study of the 'book of nature' was, of course, also increasingly

valued by Catholic scholars as an often much more reliable guide to truth than reliance on the bookish authorities. But for Protestant philosophers the call for empirical study - rather than reliance on authorities - seems to have had a special appeal, just as to them the personal study of the Bible provided better access to religious truth than the dogmata of the (Catholic) clergy. On the other hand, Sennert also rejected any need for divine help or support in the study of the book of nature. Man's capacity to penetrate the secrets of God's creation was limited, but the Creator had provided man with sufficient tools to acquire necessary knowledge and admire his creation. There was no need for divine inspiration, namely for a light of grace with which God illuminated the chosen few, an idea which was popular among (Neo)Paracelsians<sup>60</sup> - just as for the Lutheran religious truth was not the prerogative of a chosen, inspired few, in contrast to what radical Protestants asserted.

By far the most immediate and radical reflection of Sennert's Protestant - and more precisely Lutheran - allegiances, was his traducianist account of human propagation, however. This was very much at odds with the philosophical and medical mainstream of his days and he must have been aware that he risked harsh criticism. But Sennert gave his support to what by then had become the opinion of the vast majority of Lutheran theologians and defended them with his imposing medical authority against the opposing positions of Catholic and Calvinist theology. The origin of the human soul and the time when the embryo was ensouled by the specifically human, i. e. rational, soul had become a major issue of interconfessional debate<sup>61</sup>. Most Catholic and Calvinist authors<sup>62</sup> continued to adhere to the medieval scholastic concept that God created the individual soul and infused it into the growing embryo only 40, 80 or even 90 days after conception. Among Lutherans, on the other hand - as both the Lutherans as well as their opponents underlined -, traducianism had become the dominant theory<sup>63</sup>.

The reasons for this Lutheran insistence on propagation *per traducem* rather than by infusion were various. Among the ancient authorities few had upheld traducianism, but Tertullianus at least could be quoted as in defence against potential charges

of heresy<sup>64</sup>. More importantly, the Lutheran theologians, and Sennert with them, read the biblical command to "*be fruitful and multiply*" as a clear argument for traducianism, for, if God had created each soul anew, 'generation' rather than 'multiplication' would have been the proper term. As already mentioned, a God who kept busy constantly creating human souls was not readily compatible either with the predominant Lutheran conviction that God no longer intervened in the orderly workings of his Creation. Lutheran theology also seems to have inclined more strongly towards a unified view of Creation. Man was God's favourite creature but he was nevertheless subject to the same rules of nature as the animals and plants. But not even Calvinist and Catholic theologians would have argued that the animal or plant souls were infused from the outside. There was thus no need to assume a different means of propagation for the human soul - its uniqueness rested on its immortality after death.

The principal driving force behind this Lutheran advocacy of traducianism, however, was yet another one. It was the Lutheran insistence on and interpretation of the original sin. Theodor Thumm's line of argument is typical in this respect. He declared that he, like St. Augustine, would be happy to support creationism rather than traducianism, if only someone could explain to him how the individual human soul could be subject to Adam's condemnation if it did not ultimately descend from Adam's soul, but was created anew<sup>65</sup>. Similar positions can be found in the writings of other contemporary Lutheran theologians and philosophers<sup>66</sup>. Luther himself, it was claimed, was also privately convinced that the human soul propagated *ex traduce*. Like St. Augustine he had just not wanted to take a public stance on the issue<sup>67</sup>. To the Lutherans, it seems, the concept of original sin made sense only on the basis of a direct genealogical connection between the individual human soul and that of Adam<sup>68</sup>. The Catholic and Calvinist dogma, on the other hand, seemed outright blasphemy to the Lutherans. If God created each individual soul, he either would have to create it in a sinful, fallen state from the start - or, which was hardly better, he would have condemned a pure and innocent soul to be contaminated by sin when he joined it to an impure, sinful body<sup>69</sup>.



Anti-Pelagianism and the genealogical concept of the original sin as 'hereditary' - the German word is *Erbsünde*, i. e. literally 'hereditary sin' - was at the core of orthodox Lutheranism. But as Markus Friedrich has recently argued, the Lutherans' advocacy of traducianism and their understanding of the original sin also reflected a more general anti-dualist tendency in Lutheran anthropology, an insistence on the unity of body and soul<sup>70</sup>, which contrasted with the more dualistic Catholic and Calvinist approaches to the body as a kind of prison or tomb of the soul<sup>71</sup>. Ultimately, traducianism can also be viewed as having supported the social ideals of Lutheranism. It stressed and valued the importance of marriage and of matrimonial sex, both of which were perceived in much more positive terms among Lutherans, combined with a massive rejection of the Catholic ideal of celibacy. The traditional concept of infusion left only a subordinate role to the parents. Their carnal intercourse was a necessary condition, but they had no direct part in the generation or transmission of the rational soul, which assured the individuality and essence of the future child as well as its relationship with God. From a traducianist perspective, on the other hand, parenthood was unshared and completely their own<sup>72</sup>.

As one of the foremost figures in European medicine, Sennert thus lent his support to profoundly Lutheran positions and, using medical arguments, ultimately backed Lutheran theology and anthropology in general. This is not just a retrospective interpretation. It also was how opponents from across the confessional divide read him. In 1641, the Catholic inquisition put the *Hypomnemata* on the index of forbidden books<sup>73</sup>. Pietro Redondi has suggested that this condemnation was motivated by the dangerous implications which atomist theory, as in the case of Galileo, held for the Catholic dogma of transubstantiation<sup>74</sup>. If all changes and alterations in natural things were due exclusively to a changing spatial arrangement of a small number of different atoms, the transubstantiation of bread and wine into Christ's flesh and blood could indeed easily be seen to represent no real change or transubstantiation at all, but just a different spatial arrangement of the very same

atoms. But Sennert's concept of atoms would have been no threat to transubstantiation. Within his framework, the atoms of bread and wine would have had to acquire a totally new form. There is further evidence that it was indeed not Sennert's atomism but his traducianism which provoked this condemnation. As a contemporary manuscript entry in one of the copies of the *Hypomnemata* in the Vatican Library states, the book was forbidden in 1641 because it stated that "*the souls propagate per traducem*" and thus failed to see that "*the souls are created by God and infused into the body, when it is equipped with organs; they do not multiply, as the delirious dreams with Hippocrates, that is the Lutheran with the pagan*"<sup>75</sup>. Marginal manuscript annotations to the table of contents in a second copy in the Vatican Library may even directly reflect the inquisitional process. They single out chapters 1 to 4 in book IV and chapter 10 in book V, which focus on the origin of the soul, and chapter 5 in book I, maybe because Sennert seemed to come close to postulating an animate universe in which all things were equipped with some kind of natural cognition or intelligence<sup>76</sup>. The publication of a 'purified' Catholic version of the *Hypomnemata* in 1655 by Claude Bonnet also points towards traducianism as the true reason for indictment. Bonnet offers a fairly precise and faithful compilation of Sennert's work. However, as he himself underlined, he had to write one part entirely anew: the part dealing with the human soul and its propagation per traducem. Bonnet substituted it with a conventional account based on the concept of infusion<sup>77</sup>.

Sennert's traducianist views found little support even among Lutheran physicians. Perhaps his reinterpretation of traditional ideas about generation appeared too partisan and too theologically-minded a position, at a time when most physicians were keen to draw a clear line between theological and medical debates in order to claim exclusive authority in the latter. Maybe many also quite simply did not find his account convincing. After all, Sennert had not really found an answer to Thomas Feyens' earlier objection that, if the semen were animated with the human rational soul, it would have to be considered as a 'man' already while it was still in the father's or mother's body.

As Feyens had argued, in that case not only masturbation would be murder and spilt semen would have to be baptized, but, even much worse, women would be able to procreate without any need for a man<sup>78</sup>. Apart from that, traducianism was not a promising position to take for anyone who hoped to acquire a reputation and make a name for himself also among the many Calvinist and Catholic physicians of the international medical community. In the end it was, rather ironically, thanks to a papal physician that some of Sennert's ideas on the origin of the soul became highly influential in the long run. Around 1650, Paolo Zacchia in Rome, the foremost authority in mid-17<sup>th</sup>-century legal medicine, relied almost exclusively on Sennert's account when he overturned traditional ideas about the time when the human embryo was a full human being endowed with a rational soul of its own. Zacchia resolutely rejected Sennert's traducianist views, because they unduly tied the human soul to its matter. But he agreed with Sennert that the human soul was present in the embryo from the very moment of conception, and not even only three days later<sup>79</sup>. As we know, this eventually was to become the official Catholic position and has been upheld until this very day.

##### 5. Atomism and the question of indivisibility

Strictly speaking, we have so far only been talking about small particles or corpuscles. Particles, however, are not necessarily atoms, i. e. indivisible in the strict sense. Indeed, Sennert's notion of occult, specific qualities and powers, his concept of a plurality, hierarchy and multiplicity of forms, his insistence on the supraelementary material substrate of the plant, animal and human soul, and, more specifically, his ideas on spontaneous generation and on the propagation of the human soul, could all, at first sight at least, have done without the assumption of truly indivisible particles. So why did Sennert literally assume 'atoms', albeit with the exception of elementary atoms, in the more specific sense of formal minima that could physically still be divided but lost their form and essence in this case? After all, atomism had been anathema to the Lutherans, especially in Wittenberg, because it was seen to be at odds with Christian ideas

of a divinely ordained creation. Was Sennert's a particularly skilful piece of cultural politics, namely the disarming of a rival philosophy - in this case Epicurean atomism - by embracing and adapting it to the point of travesty? Retrospectively, the idea cannot be dismissed out of hand. But I believe there are more specific reasons for Sennert's endorsement of indivisibility. I suspect that Sennert realised that without indivisibility his whole theory would indeed have collapsed, for somewhat unexpected reasons.

Designed to explain the wealth and complexity of life, Sennert's concept of animated particles gave rise to a rather vexing problem: it made it very difficult to explain death. To put it bluntly: if souls, like all forms, can subsist in minute amounts of matter, how can they ever perish? The familiar argument that form and soul needed suitable tools or substrate matter to perform their functions was helpful in explaining why the workings of the soul could no longer be perceived from the outside, once the 'radical moisture' had dried up or the 'spirits' no longer warmed and enlivened the parts. But if the soul itself still survived intact - however small its substrate might be - and remained capable of becoming the dominant form again, once it was provided with additional suitable matter, human death was no longer a separation of the immortal soul from the mortal body. Death was a mere multiplication and dissemination of the soul, still bound to small particles of the matter of which the animal or man had been made up. Even the soul which informed an arm cut off by a sword would have existed forever in the particles of the arm. Only if Sennert postulated a material limit of divisibility down to which the 'radical moisture', the *calidum innatum* or whatever the immediate material substrate of the soul could be divided and beyond which it could no longer support the soul, would the soul actually either perish (in the case of plants and animals) or be separated from its matter (in the case of the immortal human soul, thanks to special divine grace).

This became a burning issue for Sennert, when his opponent of decades, Johann Freitag of Groningen, accused him of blasphemy and heresy because he had supposedly claimed the im-

mortality of animal souls and thus denied man's unique place in Creation<sup>80</sup>. Sennert took the attack seriously enough to ask the leading German Protestant faculties for their judgement on this matter. All of them confirmed that it was not heretical to state that animal souls were created *ex nihilo*, endowed with supraelementary matter and powers, and did not simply emerge from the potency of matter<sup>81</sup>. But in a way Freitag would have been quite right, if Sennert had not explicitly argued for a limit down to which the supra-elementary matter of the animal soul could be divided. The individual soul of every single animal, together with its quintessential material substrate - however tiny - would not perish until the end of time. There was nothing that could totally destroy it. The individual human soul, on the other hand would also remain bound to its material substrate, just like the animal soul, and it would even multiply when the body fell apart. The fundamental difference between the mortal animal soul and the immortal human soul would be decisively blurred, and even resurrection would have to be understood in dramatically different terms. Sennert needed a limit of divisibility for theological reasons.

### Conclusion

Sennert's atomism was an outstanding physician's attempt to lend his medical authority to Lutheran notions of Creation, anthropology and the original sin - and the pluralization in early modern medicine decisively expanded the explanatory resources on which his atomistic account could draw. His theory was, in turn, profoundly shaped by his effort to connect medical and religious argument and by the resulting need to avoid the heretical consequences which it might easily entrain. Each in its own way and with widely diverging theories, the Lutheran Sennert, the Huguenot Basso and the Arminian van Goorle<sup>82</sup> all responded to their respective religious context, to their personal ties and allegiances in the ongoing struggle among and within the various religious confessions. As each case suggests, the pluralization in early modern atomism was also, to a marked degree, the result of religious, confessional pluralization in early modern Europe.

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2. KANGRO H., *Erklärungswert und Schwierigkeiten der Atomhypothese und ihrer Anwendung auf chemische Probleme in der ersten Hälfte des 17. Jahrhunderts*. Technikgeschichte 1968; 35:14-36; BALDINI U., *Il corpuscolarismo italiano del Seicento. Problemi di metodo e prospettive di ricerca*. In: Id. et al. (eds.), *Ricerche sull'atomismo del Seicento*. Firenze, La Nuova Italia, 1977, pp. 3-76; MEINEL C., *Early seventeenth-century Atomism. Theory, epistemology and the insufficiency of experiments*. Isis 1988; 79:68-103; LÜTHY C., *The fourfold Democritus on the stage of early modern science*. Isis 2000; 91: 443-479.
3. STÜCKELBERGER A., *Lucretius reviviscens. Von der antiken zur neuzeitlichen Atomistik*. Archiv für Kulturgeschichte 1972; 54: 1-25. On the conflation of various historical personalities into the neoatomists' "Democritus" see LÜTHY C., *The fourfold Democritus...* ref. 2.
4. For useful general overviews of early modern atomism see in particular BOAS M., *The establishment of the mechanical philosophy*. Osiris 1952; 10:412-541; GREGORY T., *Studi sull'atomismo del seicento*. Giornale critico della filosofia italiana 1964; 43:38-65 and 1966; 45:44-65; PYLE A., *Atomism and its critics. From Democritus to Newton*. Bristol, 1997; CLERICUZIO A., *Elements, principles and corpuscles. A study of atomism and chemistry in the seventeenth century*. Dordrecht et al., Kluwer, 2000.
5. LARWITZ K., *Geschichte...* ref. 1. pp. 436-454, sect. 6: *Die Erneuerung durch D. Sennert*.
6. PYLE A., *Atomism...* ref. 4, p. 224.
7. Probably the closest to Sennert's approach - but written in a very different, aphoristic style - was HILL N., *Philosophia epicurea, democritiana, theophrastica proposita simpliciter, non edocta*. Colonia Allobrogum, off. Fabriana, 1619 (orig. Paris 1601); cf. MCCOLLEY G., *Nicholas Hill and the "Philosophia epicurea"*. Annals of Science 1939; 4: 390-405.
8. Nielsen was the first to note that "*the dispute about atomism had strongly pronounced confessional undertones in the early seventeenth century*"; see NIELSEN L. O., *A seventeenth-century physician on God and atoms: Sebastian Basso*. In: KREZTMANN N. (ed.), *Meaning and inference in medieval philosophy. Studies in memory of Jan Pinborg*. Dordrecht et al., Kluwer, 1988, pp. 297-369, cit. p. 348; LÜTHY, C. H., *Thoughts and circumstances of Sébastien Basson. Analysis, micro-history, questions*. Early science and medicine 1997; 2:1-73; Id., *David Gorlaeus' atomism, or: the marriage of protestant metaphysics with Italian natural philosophy*. In: LÜTHY C., MURDOCH J. E. and NEWMAN W. R. (eds.), *Late medieval and early modern corpuscular matter theories*. Leiden, Brill, 2001, pp. 245-290. Another thorough study of a famous early 17<sup>th</sup>-century German Protestant physician-atomist is MEINEL C., *In physici futurum saeculum respicio. Joachim Jungius und die naturwissenschaftliche Revolution des 17. Jahrhunderts*. Göttingen, Vandenhoeck & Ruprecht, 1984.
9. For a range of somewhat diverging accounts of Sennert's philosophy see LARWITZ K., *Geschichte...* ref. 1, pp. 436-454; RAMSAUER R., *Die Atomistik des Daniel Sennert. Ansatz zu einer deutschartig-schauenden Naturforschung und Theorie der Materie im 17. Jahrhundert*. Braunschweig, 1935; MAHNKE D., *Zur Eingliederung Sennerts*

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10. As Ramsauer has remarked, Sennert's concept of form is closer to the Paracelsian Archeus than to the *forma* of conventional scholastic philosophy (RAMSAUER R., *Atomistik...* ref. 9, p. 56); Paracelsus as well as Severinus, Crolius and Quercetanus are frequently quoted by Sennert, especially in his *De consensu*; see also the statistics compiled by ECKART W.U., *Grundlagen des Medizinisch-Wissenschaftlichen Erkennens bei Daniel Sennert (1572-1637) untersucht an seiner Schrift "De Chymicorum ... Liber"*, Wittenberg 1629. Münster, 1978, p. 94. As CLERICUZIO A., *Elements...* ref. 4, notes, the stoic concept of *logoi spermatici* and of the Augustinian 'seminal reasons' may also have had some influence (cf. BRADY J. M., *St. Augustine's theory of seminal reasons*. New Scholasticism 1964; 38: 141-158). For conventional Aristotelian notions about the process of mixture see TITELMANN F., *De rerum naturalium consideratione libri duodecim*. Cologne, off. M. Novesiani, 1544, pp. 84r-87v.
  11. SENNERT D., *Hypomnemata physica* I.5 (*Opera* I, p. 108). I will quote Sennert's works from my personal copy of the *Opera omnia*. Lyons, Huguetaun, 1656, together with the respective book and chapter (in this case book 1, ch. 5). All translations are my own.
  12. *Hypomnemata* I.5 (*Opera* I, p. 108); similar ideas appear in Newton's famous query 31 and Sennert may well have been one of his major sources in this respect; on the alchemical roots of such ideas see DEBUS A. G., *Motion in the chemical texts of the Renaissance*. Isis 1973; 64:4-17.
  13. An important source for Sennert's concept of a plurality and subordination of forms was ZABARELLA G., *De rebus naturalibus libri XXX*. 4<sup>th</sup> edn. Cologne, 1602, esp. pp. 395-399, *Liber de comuni rerum generatione*; this tradition of 'Latin pluralism' and its importance for Sennert's theory is the main argument of MICHAEL E., *Daniel Sennert on matter and form. At the juncture of the old and the new*. Early science and medicine 1997; 2:272-299; see also EAD., *Sennert's sea of change. Atoms and causes*. In: LÜTHY, MURDOCH, NEWMAN, *Matter theories*, ref. 8, pp. 331-362, esp. pp. 344-345 where she identifies various Lutheran theologians who shared similar views.
  14. Originally, Sennert accepted the idea of a further division into prime matter.
  15. Sennert quotes the Jesuit Aguilonius in support; cf. AGUILONIUS F., *Opticorum libri sex*. Antwerp, 1613, p. 379 (book 5, *propositio* 8).
  16. *Hypomnemata*, books IV and V (*Opera* I, pp. 123-172); cf. ROGER J., *Les sciences de la vie dans la pensée française du XVIII<sup>e</sup> siècle. La génération des animaux de Descartes à l'Encyclopédie*. Paris, 1963, esp. pp. 106-112 and pp. 325-331.
  17. Sennert does not explain, however, how worms and other animals with an 'animal' soul could emerge, with their superior soul, from decaying plants.
  18. The history of traducianism has been strangely neglected, in spite of its obvious importance. For a useful overview also of its rival theories see JEROUSCHEK G., *Lebensschutz und Lebensbeginn. Kulturgeschichte des Abtreibungsverbots*. Stuttgart, Enke, 1988; see also PETERS R., *Der Schutz des neugeborenen, insbesondere des mißgebildeten Kindes*. Stuttgart, Enke, 1988; WASZINK, J. H., *Beseelung*. In: *Re-*

- allexikon für Antike und Christentum*. Vol. 2. Stuttgart, Hiersemann, 1954, coll. 176-183.
19. SENNERT D., *Quaestionum medicarum controversarum liber*. Wittenberg, Henckelius, 1609, pp. 1-18, query 1: *Quae sit vis formatrix corporis animati?*
  20. In 1620, Thomas Feyens, in a widely debated book, suggested a much earlier date for infusion, namely the third day after conception. This was based on the observation that the embryo itself and the envelopes around it were formed within a few days after conception, which he took to be the work of the essential human - i. e. the rational - soul. But he maintained the concept of divine infusion (FEYENS T., *De formatrice foetus liber*. Antwerp, G. a Tongris, 1620).
  21. On the nexus between the concept of a 'seminal force' or *vis seminalis* and the concept of *impetus* see PAGEL W., *New light on William Harvey*. Basel/New York, Karger 1976, pp. 84-92.
  22. Sennert rejected this argument as an unnecessary multiplication of entities; furthermore, he argued, a human embryo which was ensouled only by a vegetative or sensitive, i. e. a plant or animal soul, would be neither man nor belong to any other living species (*Hypomnemata* IV.13 (*Opera* I, p. 145)).
  23. As a physician, Sennert sided with Galen against the Aristotelian idea that only men had semen (*Hypomnemata*, IV.9 (*Opera* I, p. 138)); on ancient theories of human generation see LESKY E., *Die Zeugungs- und Vererbungslehren der Antike und ihr Nachwirken*. Wiesbaden, Steiner, 1951.
  24. VAN MELSEN A. G., *From atomos to atom*. New York, 1960, pp. 81-89; PARTINGTON J. R., *History of chemistry*. Vol. 2, London-New York, 1961, pp. 271-276; NEWMAN W. R., *The alchemical sources of Robert Boyle's corpuscular philosophy*. Annals of science 1996; 53:567-85; ID., *Experimental corpuscular theory in Aristotelian alchemy: From Geber to Sennert*. In: LÜTHY C., MURDOCH J., NEWMAN W.R., *Matter theories...* ref. 8, pp. 291-329; CLERICUZIO A., *Elements...* ref. 4. I also know of no evidence that Sennert actually practiced chemistry himself.
  25. The relationship between early modern science (or natural philosophy) and religion has attracted considerable attention among historians of science, though, following Merton's seminal paper, primarily in respect to the influence of Protestantism (or Puritanism) on the so-called 'scientific revolution'. Cf. MERTON R. K., *Science, technology and society in seventeenth-century England*. Osiris 1938; 4:360-632; WESTFALL R. S., *Science and religion in seventeenth-century England*. New Haven, 1958; HOOYKAAS R., *Religion and the rise of modern science*. 2<sup>nd</sup> edn. Edinburgh - London, 1973; BROOKE J. H., *Science and religion. Some historical perspectives*. Cambridge, 1991.
  26. SENNERT D., *Institutiones medicinae libri V*. Wittenberg, 1611; revised editions Wittenberg, 1620; Wittenberg, 1633 (*Opera* I, pp. 307-696).
  27. SENNERT D., *Practica medicinae*. In: Id., *Opera* II, pp. 1-1095.
  28. Recently Christoph Lüthy and William Newman studied this collection more closely, while it is only mentioned occasionally in older writings (LÜTHY C., NEWMAN W. R., *Daniel Sennert's earliest writings (1599/1600) and their debt to Giordano Bruno*. Bruniana et Campanelliana 2000; 6:261-279). The work seems to be very rare and I have not been able to consult a complete collection yet (the disputations were first printed individually and then seem to have been assembled into a collective *Epitome naturalis scientiae*). In his letter to the reader at the beginning of the 1618 edition, Sennert briefly mentions its origins from doctoral dissertations some 20 years before (but not their collection as an *Epitome*) and presents it as a 'juvenile' work. According to Lüthy and Newman, the *Epitome* of 1618 is a much expanded edition.

29. LÜTHY C., NEWMAN W.R., *Sennert's earliest writings...* ref. 28; cf. *Epitome* [1618] I.5 (*Opera*, I, p. 11): *Mundus denique hic in atomo seu centro eius plenitudinis factus est.*
30. For a detailed analysis of the (very late) emergence of a more thoroughly atomist theory in the various editions of Sennert's *Epitome naturalis scientiae* see MICHAEL E., *Sennert's sea of change...* ref. 13. Sennert's interest in medicine started very early, when he was still an arts student. Already in 1596, two years before his master's degree, Sennert defended a disputation by JESSENIUS J., *De morbis, quem aer tota substantia noxius peragit, praeservatione et curatione.* Wittenberg, Dörffer, 1596, a topic which, as we will see, had an important place in the development of Sennert's atomism (I have not seen this work, but a Budapest copy is listed in PICK, F., *Joh. Jessenius de magna Jessen. Arzt und Rektor in Wittenberg und Prag* (Studien zur Geschichte der Medizin 15). Leipzig, 1926, p. 39).
31. SENNERT D., *De chymicorum cum aristotelicis et galenicis consensu et dissensu.* Wittenberg, 1619; 2<sup>nd</sup> revised edn. Wittenberg 1629. Atoms are discussed in ch. 12 (*Opera* I, pp. 230-31).
32. *Medicina practica* VI.1.1 (*Opera* II, p. 973).
33. *Hypomnemata*, Letter to the reader (*Opera* I, p. 101).
34. On the *colchodea* cf. NARDI B., *Origine dell'anima umana.* In: Id., *Studi su Pietro Pomponazzi.* Florence, 1965, pp. 231-246, note on pp. 234-35; STOLBERG M., *Die Lehre vom "calor innatus" im lateinischen "Canon medicinae" des Avicenna.* Sudhoffs Archiv 1993; 77: 33-53.
35. *Minima* are discussed already in JESSENIUS J., *De divina humanaque philosophia, progymnasma peripatheticum.* Venice, Bruinolus, 1591, where Jessenius also postulated individual *minima* of men, horses, etc.
36. Sennert possessed several of Bruno's works and even imitated him in his *Templum mnemosynes.* Wittenberg, W. Meisner, 1599. On the *Templum* and on Bruno's ultimately negligible influence on Sennert's atomism, see LÜTHY C., NEWMAN W.R., *Sennert's earliest writings...* ref. 28.
37. This was first pointed out by NEWMAN W.R., *Alchemical sources...* ref. 24. See the section 2 of part 3 of *Institutiones* V, *De operationibus ad pharmacopoeiam necessariis* (*Opera* I, pp. 631-649).
38. Laßwitz (LARWITZ K., *Geschichte...* ref. 1) already underlined the importance of medical sources for Sennert's atomism, but he rather implausibly suggested Asclepiades of Bythia as Sennert's major source. Sennert, it is true, mentioned Asclepiades and criticized him for denying the obvious when he rejected attraction (*Quaestiones medicae* [1607], disp. 3). But Sennert's atomism had very little in common with the ancient methodist school.
39. AVICENNA, *Canon medicinae...* bk. 1, fen 1, doct. 3, ch. 1; *Institutiones*, I.4 (*Opera* I, p. 316).
40. GALEN, *Peri spermatos/De semine*, book 1, ch. 16 (Kühn IV, p. 584).
41. *Quaestiones medicae* [1607], query 2.
42. FRACASTORO G., *De contagione et contagiosis morbis et eorum curatione libri tres. De sympathia et antipathia rerum.* Venice, 1546. Sennert quotes (and criticizes) Fracastoro repeatedly; see, for example, *Hypomnemata* 1.5 (*Opera* I, p. 108).
43. *Quaestiones medicae* [1607], query 2; *Pentast. illustrium* [1608], disp. 2 and disp. 5.
44. E. g. *De chymicorum*; ch. 12 (*Opera* I, p. 231).
45. SENNERT D., *Quaestiones medicae controversae quinque.* Resp. Donatus Freywaldus. Wittenberg, 1608, query 2.
46. E. g. *Hypomnemata* II.2 and II.3 (*Opera* I, pp. 110-115).
47. SENNERT D., *Quaestiones medicae controversae quinque.* Resp. Ioachim Köppe. Wittenberg, 1607, query 3: *Qua ratione pharmaca kathartika humores expurgent?*

48. *De chymicorum*; ch. 18 (*Opera* I, pp. 262-63).
49. FERNEL J., *De abditis rerum causis libri duo.* Paris, Wechel, 1548; cf. RICHARDSON L. D., *The generation of disease. Occult causes and diseases of the total substance.* In: WEAR A. et al. (eds.), *The medical Renaissance.* Cambridge, 1985, pp. 175-194.
50. When Jessen left Wittenberg for Prague in 1602, he successfully recommended Sennert as his successor.
51. JESSENIUS J., *De morbis...* ref. 30; JESSENIUS J., *De sympathiae et antipathiae rerum naturalium causis.* Resp. D. Sennert. Wittenberg, typis Meissnerianis, 1599.
52. SENNERT D., *Quaestiones medicae controversae septem.* Resp. M. Döring. Wittenberg, 1607, query 2: *An dentur morbi totius substantiae seu formae ut vocant?* Sennert elaborated on these concepts in *Institutiones medicinae*, II.2.4 (1611-edn. pp. 131-145; *Opera* I, pp. 351-354); see also *Hypomnemata*, II.2 (*Opera* I, pp. 110-111).
53. SENNERT D., *Pentast. illustrium apotematon iatrofilosofikon.* Resp. M. Vechnerus. Wittenberg, typis M. Henckelii, 1608, Disp. 2: *Ad quod genus affectuum praeter naturam referenda sit lues venerea*; Disp. 5: *Num theriaca curae febrium malignarum inserviat.*
54. This is true primarily for *De chymicorum*. Later, in the *Hypomnemata*, Sennert preferred to speak more generally of supraelementary forms again.
55. On the history of the concept see MENDELSON E., *Heat and life. The development of the theory of animal heat.* Cambridge, 1964.
56. *Hypomnemata*, II.3 (*Opera* I, p. 113). In *De consensu* Sennert also linked the concept of 'innate heat' with his interpretation of spontaneous generation. He suggested that the peculiar semen-like matter hidden in living animals might be similar to 'innate heat' with 'innate spirit' as its proximate tool. But in the *Hypomnemata* he did not specify its nature.
57. *Genesis* 2,2; as L. O. Nielsen has shown, the Reformed Sebastian Basso, on the other hand, advocated a return to the Zwinglian and Calvinist notion of ongoing divine pancausality after Creation, with the ether serving as an intermediary (NIELSEN L., *Basso...* ref. 8, pp. 344-348).
58. Protestant scholars may also generally have found it easier to break with established authorities, though by Sennert's time, Lutheranism had already evolved into an established orthodoxy itself.
59. ECKART W.U., *Grundlagen...* ref. 10.
60. A famous example is VAN HELMONT J. B., *Ortus medicinae.* Amsterdam, Elzevir, 1648 who reported divinely inspired dreams as a major source of knowledge.
61. See FRIEDRICH M., *Das Verhältnis von Leib und Seele als theologisch-philosophisches Grenzproblem vor Descartes. Lutherische Einwände gegen eine dualistische Anthropologie.* In: MULSOW M. (ed.), *Spätrenaissance-Philosophie in Deutschland 1570-1650.* Tübingen, Niemeyer (in print). I am grateful to Markus Friedrich, who directed my attention towards the marked confessional aspects of this debate and generously provided me with a manuscript of his paper.
62. A collection of predominantly Calvinist texts on this issue was published by GO-CLENIUS R. (ed.), *Psychologia: hoc est, de hominis perfectione, animo, et in primis ortu huius commentationes ac disputationes quotundam theologorum et philosophorum nostrae aetatis.* Marburg, ex off. Pauli Egenolphi, 1594; see also ZWINGER T., *Responsio facultatis theologicae in academia Basileensi.* In: SENNERT D. (ed.), *De origine et natura animarum in brutis sententiae clarissim. virorum in aliquot Germaniae academiis, quibus simul D. Daniel Sennertus a calumniis D. Ioannis Freitagii vindicatur* (*Opera* I, pp. 285-306, here pp. 288-290).
63. IUNIUS F., *An animus hominis propagetur a parentibus.* In: GO-CLENIUS R., *Psychologia...* ref. 62, pp. 87-164, here p. 161; Iunius wondered what moved Luther and

- others who followed him to favour traducianism; THUMM T., *Controversia de traduce sive ortu animae rationalis explicata theologice pariter et philosophice*. Resp. Bernhard Willdersin. Tübingen, typis Theod. Werlini, 1622; Thumm's Jesuit opponent Wangnereck, in turn, made an effort to show that at least not all Lutheran theologians adhered to traducianism (WANGNERECK H., *De creatione animae rationalis, tractatus adversus augustianos praecones aliosque haereticos traducis assertores*. Dillingen, Sutor, 1628; I owe this reference to Markus Friedrich). Recently Emily Michael (MICHAEL E., *Daniel Sennert...* ref. 13, p. 295; similarly, MICHAEL E., *Sennert's sea of change...* ref. 13, note on p. 359) already mentioned the traducianist views of some "Lutheran professors of natural philosophy"; she does not seem to have noticed the differences between the Lutheran and the Calvinist views, however, and her reference to the *Scholae seu disputationes physicae* edited by Rudolphus Goclenius is clearly erroneous; she probably confused this work with Goclenius' *Psychologia*, ref. 62, which contains texts by predominantly Calvinist theologians as well as philosophers.
64. TERTULLIANUS, *Liber de anima*. In: MIGNE, J.P. (ed.), *Patrologia*. Vol. 2. Paris, Migne, 1844, coll. 646-752.
65. THUMM T., *Controversia*, ref. 63.
66. Thus e. g. LEICHNER E., *De generatione seu propagativa animalium plantarum et mineralium multiplicatione in genere exercitationes physicae antiperipateticae XX*. Erfurt, 1649, Disp. 12 and 13; HUNNIUS N., *Epitome credendorum, oder Inhalt der gantzen christlichen Lehr*. Frankfurt - Leipzig, Meyern and Zimmermann, 1702 (1<sup>st</sup> edn. 1625), pp. 590-591; MENZER B., *Herrliches catholisches Hand-Büchlein*. Hamburg, Zieglerische Schriften, 1693, pp. 64-66.
67. MEISNER B., *Philosophia sobria, hoc est: pia consideratio quaestionum philosophicarum, in controversijs theologis, quas Calviniani moverunt Orthodoxis, subinde occurrentium*. Wittenberg, typis Martini Henckelij et Andreae Rüdingeri, 1600, pp. 904f.
68. THUMM T., *Controversia...* ref. 64.
69. The reformed theologians in Basel, in turn, complained that their opponents accused them of Pelagianism and of denying the original sin, because they rejected traducianism (ZWINGER T., *Responsio...* ref. 62). As a further argument against infusionism Sennert pointed to the birth of deformed, 'monstruous' children, whose defects would be blamed directly on God by creationists; this would not have convinced his opponents, however, because in this case the traditional idea of the powerful effects of the imagination on pregnant women offered a plausible alternative explanation.
70. FRIEDRICH M., *Verhältnis...* ref. 61.
71. Thus explicitly the Altdorf physician TAURELLUS N., *De vita et morte libellus*. Nurnberg, off. C. Gerlachiae, 1586, part 2, query 2, prop. 2: *Animam in corpore perfectius vivere quam extra corpus*. It is not quite clear, however, how Sennert and the Lutheran theologians understood the nature of the individual soul. Strictly speaking, as Th. Feyens rightly pointed out (FEYENS T., *De formatrice...* ref. 20, p. 63), traducianism would imply that all men had Adam's soul, which was created by God and henceforth multiplied. Individual men and women would differ only in their body and its specific ensoulment by a generic Adamitic human soul. Individuality - and individual sinfulness - would be purely physical, somatic.
72. Cf. BASCHET J., *La parenté partagée. Engendrement charnel et infusion de l'âme (à propos d'une miniature de la fin du XVe siècle)*. In: CASAGRANDE C. and VECCHIO S. (eds.), *Anima e corpo nella cultura medievale*. Atti del V Convegno di studi della Società Italiana per lo Studio del Pensiero Medievale, Venice 25.-28.9.1995. Florence, Sismel, 1999, pp. 123-137.

73. Unfortunately, the relevant documents of the Inquisition have not survived. I am grateful to Mons. Alejandro Cifres, the director of the Archivio della Congregazione per la Dottrina della Fede in the Vatican for this information.
74. REDONDI P., *Galileo heretic*. Princeton, Princeton Univ. Press, 1987 (orig. *Galileo eretico*. Turin, Einaudi, 1983). Redondi (p. 286) claims that the *Hypomnemata* had already been put on the Index by 1639 but provides no evidence for this early date.
75. Biblioteca Vaticana, R.g. Misc. II, 175 (int. 5).
76. Biblioteca Vaticana, Stamp. Chigi, V1254.
77. BONNET C., *Epitome universam Dan. Sennerti doctrinam summa fide complectens*. Colonia Allobrogum, Gamonetus, 1655. Following Th. Feyens, Bonnet accepted, however, that the soul was already infused on the third day after conception; see also GALLEGRO DE LA SERNA J., *De naturali animarum origine invectiva adversus Danielem Sennertum*. Brussels, F. Vivienus, 1640.
78. FEYENS T., *De formatrice...* ref. 20, pp. 62-63. STOLBERG M., *The crime of Onan and the laws of nature. Religious and medical discourses on masturbation in the late seventeenth and early eighteenth centuries*. Paedagogica historica 2003; 39: 701-717.
79. ZACCHIA P., *Quaestionum medico-legalium tomi III*. Frankfurt, Schönwetter, 1666, pp. 685-707 (book 9, Tit. 1, *De foetus humani animatione*); Zacchia developed this position in the course of time and it figures only in later editions of his work; indeed on page 53 of the 1666 edition Zacchia still calls for abortion to be equated with homicide starting only 60 days after conception.
80. FREITAG J., *Novae sectae Sennerto-Paracelsicae recens in philosophiam et medicinam introductae... detectio et solida refutatio*. Amsterdam, Blaeu, 1637; SPERLINGEN J., *Dissertatio de traduce*. Wittenberg, J. Berger, 1648; Cf. BAYLE P., *Dictionnaire historique et critique*. Paris, 1820-1824 (Repr. Geneva, 1969), vol. 13, pp. 234-243; ECKART W.U., *Der Streit zwischen Daniel Sennert (1572-1637) und Johann Freitag (1581-1641)*. In: *Deutsch-Niederländisches Medizinhistorikertreffen. Vorträge*. Münster, 1978, pp. 21-38.
81. SENNERT D., *De origine...* ref. 62.
82. LÜTHY C.H., *Thoughts...* ref. 8; NIELSEN L.Q., *Basso...* ref. 8; LÜTHY C.H., *David Gorlaeus...* ref. 8.

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Articoli/Articles

LE CONCEPT DE SEMENCE DE PIERRE GASSENDI  
ENTRE LES THEORIES DE LA MATIERE  
ET LES SCIENCES DE LA VIE AU XVII<sup>E</sup> SIECLE

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SUMMARY

*GASSENDI'S CONCEPT OF SEEDS BETWEEN MATTER  
THEORIES AND LIFE SCIENCES IN THE 17<sup>TH</sup> CENTURY*

*Gassendi's theory of molecules as seeds is not a simple adaptation of the Lucretian idea of semina rerum. It is also strongly influenced by the Renaissance concept of seeds, stemming from Marsilio Ficino's Neoplatonic metaphysical cosmology and developed in Paracelsian natural philosophy. Examining its historical context and its chemical and biological dimensions, the present study reveals the very source of his idea.*

*1. Introduction*

Dans son *History of Embryology*, l'historien anglais Joseph Needham a écrit une note significative:

*The devious connections between Greek atomism and seventeenth-century biological preformationism are now fairly clear... But otherwise excellent histories of atomism... often jump direct from Epicurus to Gassendi, entirely neglecting the Stoic-Kabbalistic 'seeds'<sup>1</sup>.*

Needham a signifié par ce curieux terme 'semences stoïco-kabbalistiques' un concept dont il a deviné l'importance dans l'évolution de l'atomisme mais qui avait été jusqu'alors complètement négligé par les historiens. En fait, nous pouvons souvent

*Key words:* Semina rerum - Atomism - Matter theories - Life sciences