

ANIMAL GENERATION AND SUBSTANCE
IN SENNERT AND LEIBNIZ

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1. INTRODUCTION

Gottfried Leibniz is well known for his claim to have “rehabilitated” the substantial forms of scholastic philosophy, forging a reconciliation of the New Philosophy of Descartes, Mersenne and Gassendi with Aristotelian metaphysics (in his so-called *Discourse on Metaphysics*, 1686). Much less celebrated is the fact that fifty years earlier (in his *Hypomnemata Physica*, 1636) the Bratislavan physician and natural philosopher Daniel Sennert had already argued for the indispensability to atomism of (suitably re-interpreted) Aristotelian forms, in explicit opposition to the rejection of substantial forms by his fellow atomist Sébastien Basso.¹

In this essay I want to set Leibniz’s philosophy in a novel perspective by comparing it with Sennert’s anticipation of his re-introduction of substantial forms. And I shall be doing this by looking at motivations for his theory of substance in his views on biological generation. I shall be especially concerned with the genesis of Leibniz’s views, and therefore with the context of his youthful commitment to atomism in the period from roughly 1666 to 1678. And I shall argue here, by a comparison with the case of Sennert, that this atomism, rather than being irrelevant to his mature philosophy of substantial forms and monads, actually throws considerable light on it. For it turns out that, despite the huge differences in the contexts in which the young Leibniz and Sennert wrote, and in the details of their views, there is a fair degree of commonality between the two in their motivations. Both Sennert and Leibniz in his youth were committed to the orthodox Lutheran doctrine of *traducianism*, the propagation of souls through the medium of parental seeds or *semina*; and both posited an indivisible core in individual

¹ For the seminal idea of this paper (so to speak) I am indebted to a remark of Antonio Clericuzio in his discussion of Sennert’s atomism in his superb (2000), 29: “Forms, however, do not disappear from Sennert’s natural philosophy. He firmly opposes Basso’s rejection of substantial forms”. For the idea of writing a paper around it, I am indebted to the invitation of one of the editors, Justin Smith. I am also indebted to the insightful remarks of several colleagues at the joint meeting of the Central Canada Seminar for the Study of Early Modern Philosophy and the Midwest Seminar in Early Modern Philosophy, September 4-5, 2004, where I read a preliminary draft. All Latin translations are my own, except where noted.

substances in which such souls were contained. In each case, also, the soul or active principle within each substance was what accounted for the law-like development from a seed to a full grown animal, a fact that both authors believed was inexplicable on a purely materialist version of atomism.

To be clear, I am not claiming here that Leibniz was consciously developing the doctrines of Sennert. Whether or not Leibniz was familiar in his youth with the details of Sennert's views, many of the views they held in common were also shared by other writers of the period. Sennert himself acknowledges a debt to Fortunio Liceti for the idea of the preformation of the seed in an animated atom, and much of what he says about the soul, substance and mixtion (the forming of chemical compounds) derives from the views of Julius C. Scaliger, whom the young Leibniz had certainly read. Again, similar views to Sennert's concerning atoms, mixtion and generation could be found variously in contemporary authors such as Joachim Jung, Robert Boyle and J. B. van Helmont, and also in Pierre Gassendi, whom Leibniz often mentions as having been influential on his early views. Indeed, in this connection Gassendi is of particular interest in that, although he opposed the doctrine of the immateriality of (all but rational) souls, he too was committed to traduction, to which he gave an atomistic interpretation indebted to Sennert's. Gassendi is also often cited as one of the earliest and most influential advocates of the biological theory of *preformation*, according to which the seeds of organisms pre-exist in invisibly small kernels in animals, rather than forming by the accretion of homogeneous matter alone. Animal development is explained in terms of the unfolding of these seeds, organized around a soul that is active in organizing the matter, rather than by the action of some other cause upon a previously undifferentiated and homogeneous matter (*epigenesis*). While this develops the views expressed by Sennert, it also prefigures Leibniz's mature doctrine of *transformation*, which, I shall argue, is best seen as a development of preformation.

The term 'preformation' has, of course, many shades of meaning. What I have in mind in ascribing it to these three thinkers is quite specific: Sennert, Gassendi and the young Leibniz, I argue, all subscribe to the view that every organism develops from a pre-existing atomic or molecular seed;² with this seed conceived as an organic body whose organization and subsequent development is governed by its soul; and with this soul conceived as a principle of activity and a final cause.

My basic argument is that there is a substantial consilience between the doctrines of Sennert and the young Leibniz, not only in their motivations (e.g. in their shared commitment to traducianism), but also in many points of detail: their subscribing to atomism, to the idea of minds or souls vivifying these atoms, to the indestructibility of these minds or souls, and to a Scaligerian theory of mixtion. Perhaps the most striking consilience between them, however, is in the position upheld by Leibniz after he has rejected atoms: that substantial forms are not to be rejected, but re-interpreted in such a way that there is one immaterial form for each organic body, that such bodies contain other organic bodies with their own forms, that the form is identifiable with the soul in the case of living beings, and that all souls originated at Creation. The root idea is that soul or form is not a faculty that is material in plants and animals, nor an immaterial substance that is infused into human bodies by God at conception, and thus superadded to them; rather it is an immaterial spirit that governs the development of each organic body and takes it through all its transformations. On this point Leibniz corrects Descartes and Gassendi in very much the same way that Sennert had earlier corrected Basson.

This supports, so I argue, a different perspective on Leibniz's theory of substance from that generally entertained. Standardly, it is held that in his later work Leibniz rejected the reality of corporeal substances in favour of the view that there are only immaterial simple substances —*monads*— and aggregates of these. I

² As Joseph Needham and Walter Pagel have observed, it was atomic theories like those of Liceti, Sennert, Kenelm Digby, Gassendi and Nathaniel Highmore that Harvey's doctrine of epigenesis was designed to combat, and not the later theory of *emboîtement*. See Pagel (1986), 501.

contend that Leibniz never abandoned the axiom that *in created things there can be no form that does not have an organic body it informs*, so that there is no created monad which is not manifested as a corporeal substance.³ Monads are substances in the sense of immaterial substantial principles. But every such substantial principle has an organic body as an immediate and necessary concomitant of its activity. This is consistent with the view urged by Hans Poser and others, that Leibniz's fundamental orientation is a Neoplatonist one, as has been argued eloquently by Justin Smith.⁴ He has provided the following succinct formulation of this line: "On such a picture, it is neither the case that there is nothing but spirit, nor that there is independently existing matter. Rather, all actual matter serves as the body of some soul or soul-like form. ... In Leibniz's variety of pananimism, there is no *hyle* that is not a *soma*, no matter that is not the organic body of some monad." (Smith, 2004), 48ff.

2. ATOMS AND SOULS

Daniel Sennert (1572-1637) is one of those thinkers who was influential in his own time, but has since faded from the memory of all but a handful of specialist scholars. His name was eclipsed, predominantly, by the thorough scholarship and wide influence of Pierre Gassendi (1592-1655), so much so that we tend to think of Gassendi as a lone voice for the rehabilitation of atomism in the seventeenth century, thus doing a disservice to all of Gassendi's atomist precursors: Thomas Harriot, Nicholas Hill, Walter Warner, Francis Bacon, Isaac Beeckman, David van Goorle, Sébastien Basson, Kenelm Digby, and many others. All of them claimed classical precedents, not only Democritus and Epicurus, of course, but often Plato

³ I committed myself to this interpretation in "Russell's Conundrum" (Arthur, 1989). Glenn Hartz (1998) has given a detailed account of Leibniz's enduring commitment to corporeal substances, and the view that for Leibniz monads are always manifested as corporeal substances has been independently put forward by Pauline Phemister (1999).

⁴ In his (2000) Hans Poser has argued that a placing of Leibniz's philosophy in the context of its Neoplatonist foundations helps explain his commitment to corporeal substances. Christia Mercer (2001) has provided an analysis of the Neoplatonist foundations of Leibniz's thought in her (2001).

too. Sennert identified his atoms with *minima naturalia*, enabling him to claim a further classical precedent in Galen.⁵ For him atoms were not indivisible in an absolute sense, but rather minimal particles of various natural kinds of bodies:

It seems, however, that the doctrine of atoms can be expounded in the following way. In natural things, which are liable to generation and corruption, because there is a perpetual alternation of generations and corruptions, it is necessary that there be certain simple bodies of their own kind, from which composites are generated and into which they pass away again... these minimal natural bodies are called atoms, atomic corpuscles, σώματα ἀδιαρετα, indivisible bodies; and they are called this because of the fact that in a natural resolution no further progress can be made to smaller ones, and vice versa; and from them natural bodies have their origin. And these indeed really are in their nature so small that they are not accessible to the senses. (1651, 17, c. 2; 1659, 446)

Sennert infers these atoms from chemical operations such as sublimation and distillation, particularly through a process of *reductio ad pristinum statum*: the fact that metals such as gold and silver can be recovered from a homogeneous alloy by applying *aqua fortis*, he claimed, is evidence that their constituent atoms remain unchanged in the process.⁶ Likewise mercury keeps its nature in all chemical changes, and can be recovered easily because atoms of the same metal tend to unite together. But Sennert also used atoms to explain a wide range of other natural phenomena, including the action of magnetism, poisons, contagion and natural

⁵ Daniel Sennert, *Hypomnemata Physica* (1636), HYP. III, ON ATOMS AND MIXTION: Chapter 1, On Atoms, p. 17, c 2. For my own original research I consulted the Venice edition (Francis Baba, 1651) in the Fisher Rare Book Library at the University of Toronto. In the late stages of composition of this essay, Roger Ariew drew my attention to the existence of an on-line photo-reproduction of a contemporary English translation of Sennert by Nicholas Culpeper, *Thirteen Books of Natural Philosophy* (Sennert, 1659), of which the last five are the *Hypomnemata*. The translation is excellent, although unfortunately Culpeper does not include the Preface.

⁶ See (1659), 452. See also Clericuzio (2000), 28-29, and the references contained therein. See also Emily Michael (2001).

generation. It is the latter that is of most interest to us here. Central to his views on generation is the idea of atoms that are animated:

ATOMS OF ANIMATE BODIES: Indeed, there are atoms not only of inanimate bodies, but of certain animate bodies too: and meanwhile the soul itself can remain whole in such minimal bodies and conserve itself: as will be said afterwards, *concerning mixtion and the spontaneous birth of living creatures*: and the Very Learned Fortunio Liceti built upon this doctrine of atoms almost the whole of his opinion on the spontaneous birth of living creatures. (1651, 21, c. 2; 1659, 453)

As Sennert goes on to argue, the apparent phenomenon of spontaneous generation is in fact a transformation of matter due to putrefaction, and the new forms of life are produced by *semina* (seeds; but also semen) latent in the rotting matter, each of which is animated by a soul. This is in keeping with his whole philosophy of generation, for which he argues clearly and methodically, beginning with the generation of plants.

A plant produces a seed, which contains a vegetative soul, and this can only be an emanation from the mother plant.⁷ Likewise each animal seed, male and female alike, contains a sensitive soul which emanates from the soul of the father or mother. As Roger explains, “the two souls are united at the moment of conception as easily as they propagate themselves, and despite its double origin, the soul of the embryo is simple: ‘a fire which burns with different flames is not called composite’ (*Hypomnemata* [287]).” This soul, moreover, is the only soul the animal has; Sennert rejects the Aristotelian orthodoxy of vegetative, animal and (in the case of humans) rational souls, all existing as entities or essences in the same being. “It is denied that vegetative, sensitive and rational are three different entities (*esse*)

⁷ Jacques Roger has already charted this progression in his *Les sciences de la vie* (1963, 108). Unfortunately, he had a different edition of Sennert’s *Hypomnemata* than mine, and I was not always able to find the corresponding passages. I have set his page references to his edition of *Hypomnemata* in square brackets, so (Roger 1963, 108 [250-258]).

working from different forms; instead they are powers of the same soul.”⁸ In the same way, “There is only one soul in man, that is the rational soul, which is however equipped with the virtues of all the inferior souls, and endowed with the faculty of vegetating and feeling” (Roger 1963, 109 [315]).

Sennert is explicit about where this leads in connection with the controversial matter of the propagation or origin of the human soul. Concerning plants and animals he takes himself to “have demonstrated on firm grounds that plants and brute animals are generated from seed (*semen*), that the seed contains a soul communicated from the thing generating, which, lying hidden in the seed, makes a home for itself suitable for a plant or animal of the same species from which it was split off.” (1651, 54, c. 1; 1659, 509). He then argues that it is only reasonable to suggest that the same account applies to human generation, and declares himself on three counts:

First, it is more probable and more consonant with the truth that the soul propagates from the parents into the offspring by dint of a divine blessing. Second, whatever else is established, whether it is the soul’s creation and infusion or its propagation and traduction, it must nevertheless be held that the soul is present in the seed at first conception, when the seed of the father and mother are conjoined in the womb and retained, and as soon as the work of formation of the human body begins; nor can there be any other efficient cause which could accomplish the work of conformation than the human soul itself. Third, even though I know great men disagree here, still, if their reasons alone are considered in isolation from their authority, I will show that they scarcely any solid reason can be brought against the propagation of the human soul through the seed. (*ibid.*)

⁸ Sennert, (1651), 59, c. 2. Cf. Roger (1963), 110, citing [75] in his edition: “The nature of a plant is not defined by a mere vegetative faculty, but each plant has a specific form, without doubt endowed with the vegetative faculty, but also with other faculties”.

Here we see a firm commitment to the doctrine of traduction; indeed Sennert defines traduction as a truth: “WHAT TRADUCTION (*TRADUX*) IS: The truth is namely that the seed (I mean the body of the seed) is the vehicle by which the soul is communicated from the parents to the offspring: which action is called traduction [*traductio*], by a word taken from plants.” The analogy, indeed the root concept, is taken from grafting: “For example, in trees, in which the seminal force is diffused throughout the whole body, if some part is cut off, and that of some other tree is inserted, the soul of the tree from which the shoot was cut is communicated into the other tree: in the same way, when the soul is conveyed with the semen of animals into the feminine uterus, so finally from this semen endowed with its own soul the complete animal emerges.” (1651, 54, c. 1)

Sennert firmly rebuts the objection that traduction is incompatible with the nobility of the human soul: “Nor does the nobility of the intellect, with respect to both essence and operations, show anything else. For it pleases the Creator thus to associate the noblest substance with the body. And so if the immortal rational soul can spend a long time in the mortal body, why may it not also be propagated with the seed? ... The nobility of the human soul is consistent with traduction.” (1651, 57, c. 2; 1659, 515).

Consistently with these premises Sennert upholds the axiom that *omnis forma est sui multiplicativa*, i.e., that every form multiplies itself; in particular, in the generation of living things, every soul multiplies itself. This is something he extrapolates from Zabarella, who held it to be the case for sensible species. But “if accidental forms have the force to multiply themselves,” Sennert argues, “how much more will substantial forms have it?” (1651, 42, c. 2; 1659, 488). Thus it is more proper to say that the soul is multiplied than that it is divided, since it has no quantity except what it gets by being predicated to something extended; but when the seed is cut off, it is extended to the whole of that body too.

Although Traducianism was Lutheran orthodoxy in the seventeenth century, this is hardly to say that it was uncontroversial, and indeed it still is.⁹ After the publication of the *Hypomnemata*, Sennert was accused of impiety in a barrage of attacks by Johann Freytag (1581-1641), who denounced him “to the Academies of the Christian world”.¹⁰ The nub of Freytag’s denunciations is precisely “the doctrine of the transmission of souls from the parents *per traducem*, which,” according to Freytag, “would imply the transmigration of souls as well as the immortality of the souls of beasts” (Clericuzio, 32). The transmigration of souls would follow from the fact that, according to Sennert’s theory, all souls were created by God *ex nihilo* in the Creation, and since then have simply propagated from one generation to the next, budding at each conception, “organizing, animating and defining each being individually”, as Roger puts it. Sennert’s answer, of course, is that the alternative —having souls created *ex nihilo* at each generation, as in the doctrine of education—contradicts what is implicit in God’s command in Genesis: “Increase and multiply!”¹¹ For, “since man consists of a body and soul, if the soul does not emanate from the parents, man would not engender man.” (1651 54, c. 1; Roger, 109 [292]; 1659, 509-10). Still, even though Sennert’s motives in defending traduction are pious enough, his defence of the self-multiplying of the soul seems only to reinforce

⁹ The *Catholic Encyclopedia* on the web comes out firmly against Traducianism, claiming that “the organic process of generation cannot give rise to a spiritual substance, and to say that the soul is transmitted in the corporeal semen is to make it intrinsically dependent on matter... Since the soul is immaterial and indivisible, no spiritual germ can be detached from the parental soul” (<http://www.newadvent.org/cathen/15014a.htm>).

¹⁰ See Clericuzio, *Elements*, p. 31, for a listing of the various works by Freytag attacking Sennert, published in 1630, 1632, 1632, 1633, 1633, and 1636. In the Preface to his *Hypomnemata*, Sennert reports Freytag as describing him as “substituting [for Aristotelian principles] his truly absurd, false, rancid, heretical and blasphemous paradoxes, ... and putting forward as principles his truly inept, colder than January, impious, false, heretical paradoxes and dogmas brimming with contradictions that have either been previously condemned or recently hatched in the brains of sycophants”! See Michael, (2000), 350.

¹¹ Sennert quotes this passage from *Genesis 1* many times: “And God blessed the fishes and the birds he had created, saying: increase and multiply; and fill the water of the seas, and let the birds be multiplied upon the earth” (p. 33, c.1); again, noting how a single tobacco seed can engender 300,000 in one year, so that by the third year it will produce “100,000 myriads” (i.e. 10⁹), he comments: “so powerful was that Divine Blessing: Increase and multiply.” (p. 48, c.1; 1659, 498). Cf. also 1659, 489, 510.

Freytag's charges. For example, appealing to the Scaligerian doctrine that "our intellect comprehends itself as a species of substances", he also endorses Scaliger's claim that "The form is so divine a thing that, since it is a substance, it fills another whole substance with itself, in such a way that out of the two one is made" (1651 41, c. 2; 1659, 486). But such claims seem only to support Freytag's charge that Sennert makes animal souls immortal.

Turning now to Leibniz, we find in his early work the same commitment to traduction, and also to the idea of atoms containing within them minds, interpreted as principles of activity and individuation. This is particularly evident in 1671, when he was working out a neo-Hobbesian account of the cohesion of atoms or naturally indissoluble bodies, and together with this a projected book, *Elementa de mente* (A II i 114). One of the governing ideas is that the mind is contained in a mathematical point, and is therefore necessarily indivisible.¹² As he later confides to Des Bosses, "[I] thought that the multiplication of souls could be explained through traduction, since many points can be made out of a single point, as the vertices of many triangles can be made through division from the vertex of one".¹³ This punctual soul is in turn encased within a physical point, variously described as an atom, globule or a *bulla*, the latter being a hollow but unbreakable bubble. Another leading idea is that mind is associated with a vortical motion, and that this is responsible for the cohesion of the globules and *bullae* and their resistance to being broken up.

The book on mind never came to fruition, although Leibniz did publish his novel views on cohesion in the *Hypothesis physica nova* (HPN) in 1672, of which the "concrete" part was sent to the Royal Society of England, and the "abstract" part, *Theoria Motus Abstracti* was sent to the Academie Française. In the latter, Hobbesian endeavours (*conatus*) are used to found a neo-Scaligerian theory of

¹² "For I shall demonstrate that mind consists in a point... Whence it will follow that mind can no more be destroyed than a point. For a point is indivisible, and therefore cannot be destroyed. Therefore body is obliterated, and dispersed to all corners of the earth. Mind endures forever, safe and sound in its point. For who can obliterate a point?" (A II i 113)

¹³ Leibniz to Des Bosses, April 30th, 1709, quoted from Loemker (1976), 599.

mixture, according to which bodies cohere when one endeavours to penetrate the space of the other.¹⁴ These endeavours, momentary in bodies, are sustained in mind, where they are proto-thoughts or emotions that can be compared and contrasted.¹⁵ The *bullae*, Leibniz explains in the *HPN*, were formed shortly after Creation by the rectilinear action of the sun's rays on the rotating matter of the Earth, like the beads in glassmakers' workshops. From then on they are "the seeds of things, the warps of species" (*HPN, Theoria motus concreti*, §6-11). Mind, he speculates in a related piece from the same time, can be generated in the place where the actions of stars, and possibly suns, collide.¹⁶

In early May 1671 Leibniz wrote an enthusiastic letter to Lambert van Velthuysen extolling the virtues of his *HPN*, and drawing together some of these themes:

I judge, however, that just as *corporalia* are to be explained by spaces and motions, so *mentalia* are to be explained by points and endeavours. I explain the way in which God could construct a body which is agitated by motions of such a kind that it would from then on be naturally indissoluble ...; indeed, what is more, I explain by means of this body, in which a mind is implanted, that mind can multiply itself, without new creation, *per traducem*, with no mention

¹⁴ See the extracts from these two works in my (2001), and my comments on the theory of cohesion in the introductory essay there. See also my "The Enigma of Leibniz's Atomism", (2003).

¹⁵ As Leibniz writes to Oldenburg, 11th March, 1671: "Every body is a momentaneous mind, and therefore without consciousness, sense, or recollection. Indeed, if two contrary endeavours could persevere in the same body for longer than a moment, every body would be a true mind. But wherever this does come about, minds are produced, and these are naturally indestructible, because, as I shall demonstrate in the appropriate place, once two contrary endeavours in the same point of a body are compatible beyond a moment, no other bodies can slip between them, nor can they be prized apart by any force for all eternity..." (A II i 90)

¹⁶ Leibniz writes: "It is possible that a mind is born in the place of a rectilinear collision of all the actions of suns; certainly of all the actions of stars. It is not at all necessary that stars themselves should have minds.... These things [are inferred] from the establishment of a Globular Hypothesis." This is the fourth fragment of a set titled *De conatu et motu, sensu et cogitatione* (A VI ii 281-2). It continues: "An Essay on Traduction (Traduce). What if congenital eggs or minds are determined in them? But what about ones that are not given birth to? Do these minds not then perish, and are they to be excluded from serving their time with the other things? Must we say that the mind alone is able to impress equally perfectly an equilateral triangle onto another body touching it in a certain way, and thereby produce a new mind? And this is to be explained by means of the establishment of globules."

of incorporeality, which no one has hitherto been able to explain clearly and distinctly. Nor do I think Traduction (*Traducem*) is despised by certain theologians except insofar as it seems to imply corporeality and divisibility, and thus mortality. That it does not is shown by the very nature of indivisibles with as much clarity as sunshine. Once this is supposed, it is at least more rational to concede human propagation to be natural than needlessly to invoke God to perform the perpetual miracle of new creation, not to speak of other difficulties. (A II i 97-98)

What is noteworthy for my purposes in these speculations is that Leibniz's minds, just like Sennert's souls, are implanted in bodies that are naturally indissoluble, that each is able to multiply itself *per traducem*, and that the indivisibility of minds is intended to support their immortality, and thus defend traduction from the charge that it implies the materiality of souls.

These themes are also evident in a short treatise *De usu et necessitate demonstrationum immortalitatis animæ* ["On the Use and Necessity for Demonstrations of the Immortality of the Soul"], written for Duke Johann Friedrich in 1671 and enclosed in a letter to Oldenburg only a couple of weeks after the letter to van Velthuysen quoted above. Here Leibniz writes of "how mind can produce mind from its substance without being diminished, or, 'On Traduction' (for I do not see why it is necessary to posit a new creation of minds as often as a man is generated, by always calling on God for perpetual miracles, like a *Deus ex machina...*)". (In another piece from the same period, perhaps connected with his project of reconciling Catholicism with Protestantism, Leibniz reveals one of the religious motivations for upholding Traduction when he observes that Augustine inclined toward Traduction since he could not otherwise explain original sin.¹⁷) Again, whereas in his letter to van Velthuysen Leibniz had referred to "the nature of

¹⁷ "Concerning traduction. Augustine approved inclining toward a certain causal Traduction, as he called it, since he could not explain the propagation of Original Sin if the soul were not an offshoot of Adam's (*decisa ab Adamo*)" (A VI ii 144). The Akademie editors date this 1670-beg. 1672 (?).

indivisibles”, without specifying what kind, in the treatise for Johann Friedrich, in a discussion of cannibalism, Leibniz explicitly calls the physical point that contains the soul or mind an *atom*: “... even if not even an atom (other than that point in which the mind is implanted) is now left of me, ...” (A II i 115).¹⁸

But as I said earlier, I am not claiming that Leibniz came to adopt either atomism or traducianism under the direct influence of Sennert’s views. In fact, Leibniz makes no reference to Sennert as an early influence, whereas he does several times claim to have followed Gassendi in his youth. The relevance of this is that Gassendi, having already followed Sennert in distinguishing certain concretions of atoms (which he calls *molecules*) as the principles of most chemical reactions, also followed him in holding that generation occurs in plants, animals and humans alike by the passing down of invisibly small seeds which are indivisible —not atoms of the elements, but still indivisible molecules or larger particles of the organism in question¹⁹:

Of course the seed is woven together from several molecules, which are not all always broken down into atoms, nor into anything close to them in primary or subsequent generation...²⁰

Each of these seeds contains a little soul that is an offshoot of its parents’ souls, in accordance with traduction, as Saul Fisher explains in this volume. But this is not to say Gassendi’s position is identical to Sennert’s. In fact, he reverts to the orthodox Thomistic position that the sensitive soul, responsible for the particular physical traits of the individual, is material in nature, since he cannot otherwise see how corporeal faculties could inhere in it. But this means that, when he comes to

¹⁸ For an account of Leibniz’s early atomism see my 2003. Concerning the uniting of the soul with an atom Parkinson observes (1992, 130) that Leibniz had stated in an earlier paper of 1669-70 (A VI i 533) that the soul is substantially united, not with all the corpuscles of the body, but with one in the centre of the cerebellum.

¹⁹ For a good recent account of Gassendi’s views, see Clericuzio (2000), 63-74. Leibniz could also have been influenced by Gassendi through his reading of Boyle, who followed Gassendi’s identification of primary concretions of particles with seminal principles.

²⁰ Gassendi, *Syntagma* (1658), Sect III, Book III, p. 285, c. 2.

the topic of human generation, he must give a different account of the traduction of the human soul than that cherished by Sennert, since the rational soul is immaterial. Thus despite subscribing to the traduction of the sensitive soul, Gassendi has the rational soul divinely implanted in the individual at conception:

For at whatever time God finally creates and infuses the rational soul we can understand there to pre-exist [*præesse*] in the seed or embryo an Irrational or sensitive soul derived from the parents, to which He unites it. That is, when the seed has broken away, it must be understood that what is broken off with the matter of the seed is only a portion of the irrational soul of the parent (for the intellective or rational soul is undivided [*individua*]), and immediately afterwards the rational soul is united with it in exactly the same way as the rational soul of the parent was united with the whole sensitive soul of the same parent.²¹

Still, Gassendi does follow Sennert's teaching that there are not two distinct souls in animals, vegetative and sentient, but only different faculties of one soul:

But when I say the sensitive soul alone, I certainly do not exclude the vegetative faculties, such as the nutritive, augmentative and generative faculties; but I do this in order not to suggest that there is in the seed, embryo or new-born human two distinct souls, one vegetative and one sentient ... (*ibid.*)

Here Sennert's position appears more consistent. If there are not distinct vegetative and sentient souls in any individual animal but only distinct faculties, all of them faculties of an individual soul, why should there be two distinct souls in humans? Why should there be an immaterial rational soul as opposed to just an intellective faculty of the sentient soul? Or if, as Gassendi suggests, the rational soul can be immaterial so long as it is accompanied by an organic body, why shouldn't

²¹ Gassendi, *Syntagma* (1658), Sect III, Book III, p. 256, c. 2.

that solution apply to all souls?²² Clearly Gassendi was compelled to adopt this position as a result of his materialist construal of vegetative and sentient souls:

It seems to me therefore that the soul is rather a certain very tenuous substance, as it were a flower of matter [*flos materiæ*], with a special disposition or arrangement [*habitudine*] and symmetry of the parts passing within the denser mass itself; in fact, because of its mobility, it can be the principle of acting, just as is a substance (for we have deduced in its own place that the primary matter from which the substance of bodies comes is not something otiose, or devoid of motion and action). ...By this argument the soul is also a body, but it is very tenuous, and with respect to the rest of the mass it is as if it were incorporeal.²³

For having avoided the charge of heresy that Freytag leveled at Sennert by making the souls of animals and plants material and therefore mortal, Gassendi could not have made the rational soul a mere faculty of the sensitive soul without committing the opposite heresy of making human souls material and therefore mortal.

Nevertheless, Gassendi was sensitive to the fact that one still had to account for the generation of highly ordered and well designed creatures, especially in the case of spontaneous generation. On this he noted Liceti's solution, that there must be souls everywhere in living or dead matter where such generation occurs. But how could one believe "that there would be a form in matter without its informing the matter?" (261, c. 2; Roger, 138). To resolve this he follows Sennert (without attribution) in holding that "the cause of generation of animals of this kind is nothing other than the seed itself, or the little soul (*animula*) contained in it and

²² Cf. Gassendi's explanation of how the rational soul can elicit corporeal vital actions: "Since it is universally unclear how in the rational soul, an incorporeal subject, there can appear corporeal faculties which are organic, inasmuch as through them a corporeal action, internal and by its own nature vital, is elicited; or how there can be received in them (as the Philosophers claim) vital actions which are corporeal; ... nothing prevents us from saying that corporeal faculties are received in the body, since the soul is the eliciting principle." 256, c. 2.

²³ Gassendi, *Syntagma* (1658), Sect III, Book III, 250, c2.

prepared for its service” (262, c. 1). This in turn leads him to assert that these seeds must be already formed, and lying dormant in matter:

Thus one can also say that even now the seeds of animals are formed, whether out of atoms or out of other principles, which God created in the beginning, and that he willed them to be endowed with forms and movements of such a kind that, on coming together, mixing, combining and remaining attached to one another in such a manner and in such order, they made such seeds, and such animals. But can one not say equally plausibly that seeds of this nature were made at the beginning of the world by the Supreme Creator of things, and dispersed variously through the Earth and the Water? [Here Gassendi quotes *Genesis I.*] And it seems on other grounds that this fecundity of the Earth and the Water should not be understood to come from the first principles of which these seeds are composed, but rather from the seeds themselves, which God himself has composed.²⁴

Gassendi concludes, just like Sennert, that this enables one to understand what is said in the Scriptures, that God created all things together, *creasse Deum omnia simul*: “insofar as God can have created the seeds of all things in the beginning, all things can be said to have been produced in that first primeval generation”. (262, c. 2) Thus on the one hand Gassendi’s account of generation recapitulates Sennert’s theory of spontaneous generation; on the other, it anticipates Leibniz’s mature view that all forms were created by God in the beginning, and lie dormant everywhere in creation as invisibly small, as yet undeveloped, seeds.

²⁴ Gassendi, *Syntagma*, 262, c. 2; also quoted in Roger *Les sciences de la vie*, 139.

3. ATOMISM AND MECHANISM

I agree entirely with the followers of those excellent gentlemen, *Descartes* and *Gassendi*, and with whomever else teaches that in the end all variety in bodies is to be explained in terms of *size*, *shape* and *motion*.²⁵

Because of Leibniz's trenchant opposition to materialism, some modern scholars have had difficulty accepting his claims that he was ever much influenced by Gassendi. From his earliest writings, they point out, he was concerned to argue the inadequacy of a purely mechanical account of body. Thus as early as 1668, Leibniz argued in his *Catholic Demonstrations* that Descartes's *extended substance* could not contain the basis for the activity of a body, and that being purely passive and unable to act, it would not qualify as a substance. But as I have argued elsewhere (2003, 215) these criticisms of Descartes by Leibniz are echoes of Gassendi's criticisms in his *Disquisitio metaphysica*: "whoever says a thing is only extension says, among other things, that it is not active. Therefore there will be no action, and no faculty of acting, in bodies."²⁶ Thus, Gassendi claims in his *Syntagma*,

[I]n natural things there is an Agent operating inside them, which is indeed distinguished from matter in part, but not from matter as a whole... since in everything there is a principle of action and of motion, ... and as it were the flower of the whole of the matter, which is also the very thing that is usually called Form.²⁷

²⁵ Leibniz, HPN §57; A VI.ii 248; cf. Garber, "Leibniz: Physics and Philosophy", in *The Cambridge Companion to Leibniz*, (Cambridge, 2000), p. 275. Leibniz continues the passage by saying that he nevertheless finds that the hypotheses of Epicurean atoms and Cartesian globules are "rather remote from the simplicity of nature and from any experiments", and that his hypothesis of *bullae* is much to be preferred.

²⁶ Pierre Gassendi, *Disquisitio Metaphysica*, Vol III 305b in (1658); quoted by Bloch (1971), 207. As I have noted elsewhere (2003, 215, n73), Leibniz acknowledges his debt to Gassendi on this point, writing to Honoré Fabry: in December 1676 "Truly, I hold for certain that there are incorporeal substances, that motion does not come from body but from outside; ... Nonetheless I agree with Gassendi rather than Descartes that the essence of body does not consist in extension..." (A II i 289).

²⁷ Gassendi, *Opera*, I 336a, 337a; cf. Bloch (1971), 216.

Now what Gassendi here calls *form* is very much like what Sennert meant by the *spirit* that was the causal means for the soul's operations. Sennert had spoken of the spirit as an "innate heat (*calidum innatum*)" that is the agent or principle of activity, acting as a vehicle for the soul. Gassendi's description of the soul as a "sort of little flame" is also evocative of Sennert's comparison of the soul derived from the two parental souls as "a fire which burns with different flames":

It seems therefore that this soul is a sort of little flame [*quandam flammulam*] or very tenuous kind of fire, which thrives or keeps burning for as long as the animal lives, when it no longer thrives but is extinguished, the animal dies.

Thus Gassendi can be seen as (perhaps implicitly) assimilating Sennert's immaterial soul to the semi-material spirit that assists it. Leibniz, on the other hand, followed Sennert in insisting on the *immateriality* of all souls. Nevertheless, in his early work he defended this in terms of the unextendedness of minds due to their consisting in points, a fact which also accounted for their indestructibility. With minds so very much implanted in matter, and souls governing bodies by means of vortices, we can say that perhaps Leibniz was not after all exaggerating when he referred to this earlier phase of thought as "when I was more materialistic". At any rate, a Gassendian strain in his early thought seems quite conceivable.

In this connection it is hard to resist seeing something of Gassendi's *flos materiae* ("flower of matter") in Leibniz's talk of a *flos substantiae* ("flower of substance").²⁸ In the treatise on resurrection he wrote for Duke Johann Friedrich (21 May 1671), he writes: "Even the Jews relate the story that in a certain little bone they call the *Luz*, the soul survives intact in all cases together with the flower of substance." (116) Leibniz summarizes some of the main points of the treatise more pithily in German in the body of the letter accompanying the treatise:

²⁸ This is hardly conclusive evidence of influence, of course. The alchemical literature abounds with talk of the *flos* of one substance or another, and Leibniz himself mentions the "chymists" in talking about the kernel of a body's substance. But so far as I can determine, the term *flos materiae* is original with Gassendi, and likewise *flos substantiae* with Leibniz.

In particular, I hold fast to the opinion that every body —people as well as animals, herbal plants and minerals— has a kernel of its substance which, distinct from the *Caput Mortuum*, is understood to be just like what the chymists take “from the damned and phlegmatic earth”. This kernel is so *subtle* that it even remains in left over in the ashes of things that have been burnt, and can, as it were, draw itself together into an invisible *centre*. As one can, to a certain extent, use the ashes of plants as seeds, and as the salient point in foetus or fruit of a plant or animal already encompasses in itself the kernel of the whole body... Now as this kernel of substance consisting in a physical point (the proximate instrument, and as it were the vehicle of the soul constituted in a mathematical point) remains always, so it is of little consequence whether all gross matter is so in us...²⁹

Leibniz’s references to the “damned and phlegmatic earth” is certainly to the alchemist literature.³⁰ But the passage about the kernel of substance remaining intact in the ashes of things that have been burnt (“lying dormant”, to use his later phrase) is evocative of what Catherine Wilson (1995, 120) describes as “a beautiful passage” in Gassendi’s *De plantis*, where he talks of the souls of grains of wheat that may apparently be lost by boiling, roasting, or crushing, possibly surviving these ordeals “to be preserved like trees that are dormant through the winter and those swallows of northern climates, and in particular of Muscovy, that grow stiff in the ice,” before awakening to the warmth of Spring.

But whatever may have been the sources from which Leibniz developed this view, it certainly opens a fascinating window on the development of his thought, and in particular on his motivations for atomism. This is particularly relevant for

²⁹ Leibniz, letter to Duke Johann Friedrich, 21 May 1671; A II 1 58, p. 108.

³⁰ Kenelm Digby (*Two Treatises* (Paris: Blaizot, 1644), *Of Bodies*, ch. XVI) explains that “water, the third instrument to dissolve bodies, dissolveth calx into salt, and so into *Terra Damnata*” 135: “the more grosse and heavy earthy partes (having nothing in them to make a present combination between them and the water) do fall downe to the bottome, and settle under the water in dust. ... Which ordinary Alchymistes looke not after: and therefore call it *Terra damnata*: but others, find a fixing quality in it, by which they perform very admirable operations.” 136.

his writings in the Spring of 1676, where he asserts atomism with increasing vigour despite the fact that the theoretical foundation provided by the theory of cohesion in the *Theoria motus abstracti* has foundered on the reefs of the infinite. By then he has concluded that there are after all no infinitely small things, and also that “endeavours are true motions, not infinitely small ones” (A VI iii 492). Thus the theories of cohesion and of indivisibles he had proposed in the *TMA* are both overturned. But instead of rejecting atoms, he assumes they are necessary *because* there are minds: “There seem to be elements, i.e. indestructible bodies, precisely because there is a mind in them.” (A VI iii 521) One reason Leibniz gives for this is that mind alone can give a criterion for something’s remaining self-identical; another that there is nothing in purely material bodies to ground the laws of motion. But the indissectible bodies Leibniz assumes also have a biological flavour: “Body is as incorruptible as mind, but the various organs around it are changed in various ways.”³¹ What this indicates is a continuing source of motivation for his atomism in the theory of animal generation and its connection with theological doctrine. Not only did mind-containing atoms solve the problem of the self-identity of substance, but the indestructibility of mind entailed the immortality of the soul, and solved the problem of the origin of forms.

This biological-cum-theological connection is confirmed by Leibniz’s sustained commitment to the doctrine of the flower of substance he had outlined in his thesis for Duke Johann Friedrich, as evidenced in a piece written in February 1676, “On the Seat of the Soul”. There, commenting on Boyle’s work *On the Possibility of Resurrection* (1675), he refers to the paper he had been instructed to prepare for the Duke six years before, reaffirming that “the argument based on cannibals is demonstrative, and proves that a flower of substance must be understood” (A VI iii 478). “Add to this,” he says, “what Borel has in his *Microscopic Observations* about

³¹ (A VI iii 510) Again: “Every mind is organic ... The transmigration of souls is sufficiently refuted by new experiments concerning the already preformed foetus” (A VI ii 394)

the shape of the cherry tree enclosed in the shell of the seed or of the wild fruit.” In this rendition of the doctrine, however, Leibniz makes no reference to the multiplication of minds, perhaps because he no longer subscribes to his earlier view that the soul is situated in a mathematical point.³² Here the “flower of substance is our [whole] body, subsisting perennially in all changes”, or at least “is diffused throughout the whole body, and in a way contains only form.” (A VI iii 478). This brings him more in line with Sennert’s view of the way the soul informs the body: the soul is implanted in the body, which is invisibly small prior to conception, and occupies all of the body as it grows.

Indeed, as Christia Mercer has observed, a fascinating aspect of this flower of substance doctrine is the way it anticipates the mature doctrine of the dominant monad.³³ The soul or form implanted in the flower of substance operates or has influence through the whole organic body, and is wholly responsible for the self-identity of the individual. Thus despite the dramatic change in death, where the volume of matter organized by the soul shrinks to some minute portion, at resurrection the kernel of substance can diffuse itself through a quantity of matter equal to what it did before death, and thus reconstitute the same individual. This prefigures Leibniz’s later doctrine of *transformationism*, according to which death is merely a transformation of the organism in such a way that the domain of influence of its dominant monad shrinks to a physical point.³⁴

³² However, Leibniz still claims that minds do not obstruct matter because they take up no volume: cf. “Immortalitas mentis mea methodo statim probata habetur, quia ... rerum cursum non imminuit. Quia mentes n’ont point de volume.” (A VI iii 581-2)

³³ Christia Mercer, *Leibniz’s Metaphysics: its Origins and Development* (Cambridge/New York: Cambridge University Press, 2001), 282. In this book (200ff., 223ff.) Mercer traces Leibniz’s sympathy to the *rationes seminales* of Plotinus and Ficino to the influence of his teacher Jakob Thomasius.

³⁴ A representative statement of this mature doctrine is given in Leibniz’s *Specimen Inventorum* of ca. 1686: “Indeed, just as some people have proposed that every generation of an animal is a mere transformation of the same animal now living, and a kind of accretion that renders it sensible, so by parity of reason it seems defensible to hold that every death is a transformation of the living animal into another smaller animal, and is a kind of diminution by which it is rendered insensible” (A VI.iv 1623-4; Arthur (2001), 317). Cf. Leibniz’s letter to Arnauld of October 9, 1687, where he cites both Leeuwenhoek and Swammerdam in support of his belief in transformation.

This raises the question: why did Leibniz abandon atomism in favour of his doctrine of transformationism, where corporeal substances, unlike atoms, do not retain the same material casing, size and shape? A related question is: when did this change in his views occur? It is hard to be precise. As we have seen, the atoms of 1676 are already conceived as cores of organic bodies, and by November of that year (in his dialogue *Pacidius Philalethi*) Leibniz has rejected Gassendi's perfectly hard atoms, arguing for an infinite enfolding of matter, with one fold inside another and no last fold, in keeping with his rejection of a categorematic infinite division. A month later he visits the Dutch microscopists, Leeuwenhoek and Swammerdam, who would have shown him the fantastically minute living organisms in apparently inert matter which they saw as dazzling visual evidence for preformationism. It is tempting, in light of Leibniz's repeated later references to this evidence, to see it as profound factor in his adopting transformationism. But although it can hardly be discounted as an influence of his subsequent views, it is hard to see it as decisive for his rejection of atoms. On the one hand, to judge from the similarity of his "kernel of substance" to the views of Gassendi and Sennert, there is no reason to think he would see atomism as in conflict with preformation. And given his explicit appeal to Pierre Borel and the preformation of the tree in a cherry stone, the Dutch scholars' evidence for preformation must have been marvellously confirming, but not revelatory.³⁵ On the other, the rejection of atoms may have been conditioned more by developments internal to his thought on the infinite and the collapse of his endeavour theory of cohesion.³⁶ What we can say, though, is that by 1678 we find him rejecting atoms and advocating the necessity of forms in almost the same breath:

³⁵ One might add that Swammerdam himself subscribed to "living atoms" in the sense of smallest living organisms, so that Leibniz's exposure to his thought is unlikely to have been a cause in his abandoning atomism.

³⁶ Just how Leibniz could have simultaneously maintained a commitment to both atomism and the actually infinite division of matter is the subject of Arthur (2003).

It must also be demonstrated that every body is actually divided into further parts, i.e. that there are no atoms... Here therefore the soul must be treated, and it must be shown that all things are animated. Unless there were a soul, i.e. a kind of form, a body would not be an entity, since no part of it can be assigned which would not again consist of further parts, and so nothing could be assigned in body which could be called *this something*, or *some one thing*. That it is the nature of a soul or form to have some perception and appetite, and why.³⁷

and in another piece written not long after this:

Every body is organic, i.e. is actually divided into smaller parts endowed with their own particular motions, so that there are no atoms... Every body is animate, i.e. has sensation and appetite...

Substantial form, or soul, is the principle of unity and of duration, matter is that of multiplicity and change... Every form is in a way a *soul*, i.e. capable of sensation and appetite.³⁸

What is interesting about these passages is the link they show in Leibniz's own mind between the organic nature of bodies and the falsity of atomism. But equally, this change in Leibniz's philosophy can be seen in terms of an abandonment of the essentially Cartesian programme to understand the way forms "inform" matter in terms solely of the laws of motion. As Malebranche expressed that programme, "all the parts essential for the machine of animals and plants are so wisely disposed in their germs that they will, in time and as a consequence of the general laws of motion, assume the shape and form which we observe in them."³⁹ Leibniz's change of heart concerning mechanism is connected with his critique of its inability to account for individuation. The laws of motion (as he conceived them prior to 1678)

³⁷ "Conspectus for a Little Book on the Elements of Physics", (Summer 1678-Winter 1678-79?): Arthur (2001), 233-235.

³⁸ "Metaphysical Definitions and Reflections", (Summer 1678-Winter 1680/81): Arthur (2001), 245-247.

³⁹ Malebranche, [1688] (1997), 176; quoted from Pyle (2003), 171.

do not constitute form in such a way as to provide the basis for the self-identity of an individual substance. But let me attempt to make this clearer by comparing Leibniz's re-introduction of substantial forms with Sennert's.

4. REINTRODUCING SUBSTANTIAL FORMS

Sébastien Basson (1592-1655) was in his late twenties when he published his *Philosophiæ naturalis* (1621), a vigorous championing of atomism. According to Basson, atoms were created by God (p. 14), they “originated after the first creation, and are free from all destruction” (126). Following Plato, he claims that, “these primary particles are so minute that, unless very many of them come together into one mass, they do not affect the senses” (126). Various orders of compound particles are formed through composition: “From these primary particles secondary ones are composed, and from the secondary ones tertiary ones, and from the tertiary, particles of fourth, fifth and sixth degree, etc.” The primary particles are those of the elements and of the five chemical principles (earth, salt, mercury, sulphur and phlegm), and these “conserve their own nature in a mixture, and act otherwise than through the force of some form” (126). The form of a mixture is characterized as “a composition or singular mixture”. “Hence through the whole variety of composition, things can be varied *in infinitum*.” (126) In other words, the generation of forms is explained entirely in terms of addition or subtraction of particles and change of their mutual situation:

Furthermore, parts varying to infinity can be forged in this way from those very different prime particles; and through either the subtraction or addition of some particles, or the variation of the situation of parts, it is not difficult to understand that some pass over into the nature of others...⁴⁰

⁴⁰ Translated from the quotation given in Clericuzio (2000), 40; Clericuzio cites it as p. 72 in the Amsterdam edition of *Philosophiæ naturalis*.

From this description, Basson perhaps sounds more of a Democritean than he was. In fact, for him atoms do not combine by pure chance, as in materialist atomism, but through appetite, attractions and sympathies, with which they are endowed by the universal spirit or world soul, depending ultimately on the will of God:

We have said that that universal spirit endows those elements with an appetite doubly conjoined... [It] excites two motions, the primary one being that by which like attracts like... the secondary motion being that by which there is a connection between them, as long as like has an appetite for like.⁴¹

Nevertheless, despite appealing to such non-mechanistic causes of combination, Basson's explanation of the natural phenomena produced by them is entirely in terms of corpuscular combination, dissociation and rearrangement of the elements. The forms are mechanistically explained, and the only teleology resides in the actions of the universal spirit, acting under God's direction.

For Sennert this was quite unacceptable, but his reasons have nothing to do with a rejection of spirit as a causal agent. What was absurd for him was the notion that forms could be reduced to mere combinations and situations of elements. He makes this criticism in the *Hypomnemata*, where he explicitly criticizes Basson for rejecting substantial forms. Noting the difficulty Zabarella has in explaining how, as an animal acquires parts in growing, the soul manages to extend to the accruing parts, he comments that this "is so obscure as to make Sébastien Basson, otherwise perspicacious enough in Physics, propose that substantial form be denied, and hold, absurdly, that form is nothing but a certain aggregation of parts of the same kind optimally concentrated" (1651, 41, c. 1; 1659, 486). Sennert follows Zabarella and Scaliger in claiming that the soul does not itself move, nor does it make sense for it to change by an accretion of matter; rather "the soul remains numerically the same throughout a whole life, and as new matter arrives it is extended to inform it"

⁴¹ Again, this is translated from the quotation given by Clericuzio, *Elements*, p. 40, n. 21, cited as p. 391 in the Amsterdam edition of *Philosophiæ naturalis*.

(*ibid.*). It does this “not by a motion to inform new matter, but in a certain way that is occult and hidden from us; and even if Basson ridicules these things, they are nonetheless very true when rightly explained.” (1651, 41, c. 1; 1659, 487). The trouble people have had stems from this one mistake: “that they attribute to form and soul things which belong to bodies, namely quantity, divisibility and parts.” (*ibid.*)

But Sennert’s reasons for rejecting the sufficiency of Basson’s construal of form as an aggregation of elements are perhaps more transparent in his *De chymicorum* (1619), written two years before Basson’s *Philosophiæ naturalis*:

The elements give the matter, but not the form. That mixture, *qua* mixture, is informed by elementary forms, I do not contest. Yet I deny that a specific form for each thing, which gives the essence and name of the thing, is produced from the elements. For there is in every natural thing, and in the parts of body, besides the matter that the elements supply, a certain divine principle and fifth nature, by which they are what they are, and are reduced to a certain family of a natural species. For elements are material, and so are not capable of giving rise to action. *De chymicorum* (1619, 358)

There is quite a lot packed into this succinct passage. First there is the whole question of the forms of mixtures. As Emily Michael has explained, Sennert’s own position had undergone a wholesale change from his earlier writings, in which he had upheld the doctrine of the refraction of forms advocated by Averroes and Zabarella, according to which the elements lose their individuality on becoming mixed, and there emerges a form of the compound substance. But by 1619 Sennert had gone over to “the opinion of Avicenna that the Elements not only remain in the mixtures, but also retain their forms perfectly and integrally.” The same experiments that had convinced him of the existence of atoms of matter by 1619 had also convinced him that they retained their forms.

But according to Basson's atomism, the forms of the mixtures that the atoms combined to make are nothing more than combinations and situations of the constituent atoms. It seemed impossible to Sennert that the individual natures of different natural kinds, especially living things, could be accounted for in this way. "Even if maybe Democritus thought so, natural things do not come about through the fortuitous collision of atoms."⁴² On the contrary, "all qualities and properties of things flow from their forms".⁴³ Even if in every natural thing there is a semi-material spirit or innate heat (*calidum innatum*) that is the agent or principle of activity, the spirit is subordinate to the form or formative power: "natural things come about under the direction of a superior form which by the instrument of heat attracts, restrains, mixes and organizes everything as a work in progress."⁴⁴ It is the form, the soul in living things, which is responsible for generation.⁴⁵ These immaterial forms determine all the actions and passions of any natural thing:

Today too in the generations of things, mixtion does not occur by the Elements running together of their own accord to constitute each thing, but every one is directed by a form. For forms are the divine and immutable principle that determines all the actions and passions of a natural thing; and they are, as it were, the instrument and hand of the most wise Creator and Workman God, who in creation freely bestowed this force and efficacy onto these his instruments, things than which nothing more marvellous can be thought. (1619, 353)

But if the atoms retain their specific forms while in a compound, and the compound has a form of its own, then there must be more than one form in a compound. Sennert did not shrink from this implication, but rather developed it

⁴² Sennert (1676, vol III, 780); translated from Emily Michael's Latin quotation (2001), 357, n91.

⁴³ Sennert (1676, vol I, 153) translated from Michael's Latin quotation (2001), 356, n87.

⁴⁴ Sennert (1676, vol III, 780); translated from Emily Michael's Latin quotation (2001), 357, n91.

⁴⁵ Sennert (1619, 353). Cf. Clericuzio: "*Semina* organize matter, which is completely inert. The fortuitous concurrence of atoms cannot explain the generation of natural bodies. Even in the smallest atoms there are seminal principles which inform and give instructions to the passive matter." (2000, 30; Sennert, (Amsterdam ed), 420)

into a hierarchical analysis of substances. Taking inspiration from both Jacopo Zabarella and Jacob Schegk (1511-1587) he wrote: “Nor does it imply any absurdity that besides the specific form there should be still other subordinate forms” and that “There is no absurdity in saying that in one substance there are many forms”.⁴⁶ As Emily Michaels explains (2001, 353), not only do elemental atoms (e.g. of sulphur, salt or mercury) combine into compound atoms, which can in turn be “subordinate to a higher supervening compound form, e.g. of gold or silver”, even “corpuscles that are substances can be combined to form inanimate bodies that are not substances, e.g. water and wine mixed”—these are the same *entia per aggregationem* that will figure prominently in Leibniz’s writings about substance. But this also implies that the bodies of substances, living things, contain a plurality of subordinate forms, each one governing one of the compounds from which the body is composed:

To me it seems more consonant with the truth that in living bodies there are many auxiliary and subordinate forms, yet such that one form is principal and ruler [*domina*] and informs the living thing, and is that from which the living thing gets its name.⁴⁷

That is, the dominant form is the substantial form of a living thing, identifiable with its soul. The substantial forms of the various substances making up its body are subordinate to it so long as it is alive. But on death, says Sennert, again following Zabarella, the dominant form is extinguished, and the body is reduced to the next lower grade of forms making up the substances that compose it.

Turning now to Leibniz’s version of the doctrine of substantial forms, we find him boldly taking the next step at which Sennert had hesitated: that of ascribing immortal souls to animals. Thus in “Wonders concerning corporeal substance”, jotted down on the back of a bill in 1683, Leibniz writes:

⁴⁶ Sennert (1676, vol I, 218) translated from Michael’s Latin quotation (2001), 347, n64.

⁴⁷ Sennert (1676, vol I, 218) translated from Michael’s Latin quotation (2001), 347, n64.

Every created thing has matter and form, i.e. is corporeal. Every substance is immortal. Every corporeal substance has a soul. Every soul is immortal. It is probable that every soul, indeed every corporeal substance, has always existed from the beginning of things. A pile or entity by aggregation such as a heap of stones should not be called a corporeal substance, but only a phenomenon. ...

There are as many souls as there are substantial atoms or corporeal substances... This puts an end to the inextricable difficulties concerning the origin of things and forms, because they have no origin and there is no generation of substances.⁴⁸

Thus Leibniz adopts a position not unlike that recommended by Gassendi to account for spontaneous generation: the souls of such animals have existed as the forms for their substantial atoms since the Creation. Only this is now extended to all animals, and indeed to all substances: for Leibniz, there are no substantial forms that are not the forms of living beings of some order or other, no matter how lowly. But there is no traduction in Sennert's sense, that is, no multiplication of souls. Each substantial form has existed from the Creation, and is just as impervious to destruction as he had previously held the human soul to be.

Sennert had contended that his living atoms could, through the faculty of the soul they contained, extend to a growing body under the direction of the soul and its nutritive faculty, in which case they would be a dominant form, with the subordinate form-matter compounds acting as the matter for that body. On his "flower of substance" view, Leibniz had maintained that the human soul would not die, but would shrink back down to a physical point. Now he has extended this analysis to all forms: although animals evidently die, their souls are not destroyed, but only their realm of influence. Typically, Leibniz writes in the *Monadology*: "There are no *souls* which are completely *detached* from matter, and no *spirits* without bodies. ... [B]ecause of this there is never either complete generation nor

⁴⁸ "Mira de natura substantiae corporeæ", A VI iv 1465: Arthur (2001), 262-265.

total death in the strict sense, which consists in the detaching of the soul... [W]hat we call *death* is enfolding and diminution.”⁴⁹ (278) This is true even of the spermatozoa identified by Leeuwenhoek:

§75. These *animals*, of which some come to be raised to the level of larger animals through the process of conception, we call spermatic. But even those among them which remain within their own kind, i.e. the majority of them, are born, reproduce themselves, and are destroyed, just like the larger animals. It is only a small number of the elect who move up onto a larger stage. (278-9)

Sennert, of course, knew nothing of these spermatic animals. There is, nevertheless, a parallel to Sennert’s view. Whereas Gassendi (rather uneasily) submitted to the orthodoxy that the rational soul is superadded to the material human soul at conception, Leibniz has an “elevation” of certain immaterial souls to the “elect” or “society of minds”, reminiscently of Sennert’s idea that the Creator “associates the noblest substance” with such fertilized seeds at the moment of conception.

Meanwhile, we find a strong (even if unwitting) echo of Sennert in Leibniz’s doctrine of the dominant and subservient forms:

§70. We can see from this that every living body has a dominant entelechy, which in an animal is its soul; but the parts of that living body are full of other living things—plants, animals—each one of which also has its entelechy or dominant soul. (278)

5. CONCLUSION

In this essay I have tried to establish that there is a strong consilience between the views on generation of Sennert and Leibniz. Both authors are committed to the origin of forms in Creation itself, as indeed is Gassendi (although they, like the young Leibniz, have forms multiplying throughout history). Both Sennert and the mature Leibniz are committed to the view that every substance has its own

⁴⁹ Woolhouse and Francks (1998), 278.

substantial form, conceived as an immaterial architectonic principle that governs its development, and “determines all the actions and passions of a natural thing”, and that this form is the soul in living things. Both hold that the forms of substances that are components of the body of another substance remain intact, even though subordinate to the dominant form governing that body, so that within any complex organism like an animal there is a hierarchy of forms. But at the foundation of their views in common is a principle also shared by Gassendi, that *there can be no form in matter without its informing the matter*. This is the foundation of the preformationism upheld by all three authors. Granted that all souls were created at the beginning of the world, whether they multiply at every conception, as in Sennert, Gassendi and the young Leibniz, or whether they remain intact through all time, as in Leibniz’s mature view, they must always have been accompanied by an organic body. Gassendi allowed teleology a role in generation and animal development; Leibniz, reminiscently of Sennert in his criticisms of Basson, could not see how a purely material form or soul could perform that function. On their way of conceiving it, a form is responsible for the individuation of a substance, and thus can neither be educed from mere matter nor superadded to it.

Sennert and Gassendi (at least in the case of spontaneous generation) inferred that a soul can never come into being where there was not already organic matter organized by a soul, and therefore that every existing soul has a continuous history traceable back to the Creation itself. Leibniz, with admirable consistency, inferred that the converse has an equal claim to truth: just as each soul has a continuous history from the beginning of time, so it will continue to exist until the end. But there are no disembodied souls in the whole of creation. As he writes in 1705:

There must be machines in the parts of a natural machine to infinity, so many enveloping structures and so many organic bodies enveloped, one within the other, that one can never produce any organic body entirely anew and without any preformation, nor destroy entirely an animal which already exists. ... For

since animals are never formed naturally from an inorganic mass, mechanism, although incapable of producing their infinitely varied organs anew, can at least draw them out of pre-existing organic bodies by a process of development and transformation. ... I have said here that there is no part of matter that is not actually divided and does not contain organic bodies, that there are also souls everywhere as there are bodies everywhere, that the souls and even the animals subsist always, that organic bodies are never without souls and that souls are never separated from organic bodies...⁵⁰

This comparison with Sennert and Gassendi casts a different light, I believe, on Leibniz's ontology. Granted, Leibniz was no dogmatist, and it certainly wouldn't have been atypical of him to have changed his position on corporeal substances later in life. This is precisely what most of Leibniz's recent interpreters have asserted, claiming that, if not already in his middle period, then certainly in his mature work, Leibniz came to abandon his earlier commitment to corporeal substances in favour of an immaterialist monism where monads are the only real constituents of the created world.

But I believe this immaterialist monism is undercut by the development of his position I have outlined here. Granted it is beyond question that for Leibniz forms have a more fundamental reality than bodies. It is also plausible that he was sympathetic to the Neoplatonist theory that bodies emanate from these forms, as the forms themselves do from God, and that (especially later in life) he applied himself to giving a construal of the former kind of emanation in terms of the perceptions of monads. But none of this detracts from the axiom that *there can be no form that does not have an organic body it informs*, which Leibniz appears to have upheld consistently throughout his career. For without a body and organs of perception, a monad cannot perceive. As Leibniz wrote in 1676: "Since in us there is nothing but mind, it is a wonder how so many different things are perceived in it.

⁵⁰ Leibniz, "Considerations on Vital Principles and Plastic Natures," (1705), Loemker (1976), 589-590.

Actually, though, it is added to matter, and without matter it would not perceive as it does” (A VI iii. 518; Parkinson (1992), 77). It is by means of the body that the rest of the universe is represented in the soul; and the fact that the perceptions we receive are of various things is the ground of the argument for plurality, so that matter is the *principium multitudinis*, the principle of multiplicity; again, without a body, a substance could not be acted upon, so matter is the *principium passionis*, the principle of being acted upon. In a nutshell, if there were only body-less monads, there would be only one monad, namely God.

In conclusion, it does not seem that Leibniz ever abandoned corporeal substances in later life. For even in the *Monadology*, which commentators promote as a prime example of his late idealism, Leibniz upholds the necessity of an organic body to each monad. Even though the name monad now denotes immaterial entelechies rather than body-form composites, bodies are their vehicles of perception, and thus on the one hand necessarily organic, and on the other hand essential to each monad’s being able to represent the universe:

§63. The body belonging to a monad, the monad being either its entelechy or its soul, makes up together with that entelechy what we can call a *living thing*, and together with a soul what we call an *animal*. Now that body of a living thing or animal is always organic, because, since every monad is a mirror of the universe in its own way, and since the universe is regulated in a perfectly orderly manner, there must also be order within that which represents it, i.e. in the perceptions of the soul, and therefore also in the body by means of which the universe is represented in the soul.⁵¹

No doubt this interpretation of Leibniz’s monads will be disputed. But if I have been successful in this essay, his earlier atomism will no longer seem irrelevant to the development of Leibniz’s mature philosophy of substance, and his reintroduction of substantial forms, as well as his vaunted solution to the problem of the origin of

⁵¹ Leibniz, *Monadology*, Woolhouse and Francks (1998), 277.

forms, will be seen to belong to the same context of biological and theological concerns that confronted his atomist predecessors, Sennert and Gassendi, in their theories of animal generation.

Daniel Sennert (November 25, 1572 – July 21, 1637) was a renowned German physician and a prolific academic writer, especially in the field of alchemy or chemistry. He held the position of professor of medicine at the University of Wittenberg for many years. Daniel Sennert was born in 1572 in the city of Breslau (now Wrocław), at the time part of the Habsburg Monarchy. His father, Nicolaus Sennert, was a shoemaker from Laehn, Silesia. Gottfried Leibniz is well known for his claim to have “rehabilitated” the substantial forms of scholastic philosophy, forging a reconciliation of the New Philosophy of Descartes, Mersenne and Gassendi with Aristotelian metaphysics (in his so-called Discourse on Metaphysics, 1686). Much less celebrated is the fact that fifty years earlier (in his *Hypomnemata Physica*, 1636) the Bratislavan physician and natural philosopher Daniel Sennert had already argued for the indispensability to atomism of (suitably re-interpreted) Aristotelian forms