FRANCIS BACON AND *SPIRITUS VITALIS*

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During the last years of his life, the years 1620 to 1626, Francis Bacon was busy preparing materials for the *Instauratio magna*, the colossal six-part sequence of works which was to be the crowning achievement of his philosophical career. He did not finish the *Instauratio* and he knew that he would not finish it; its scope was beyond the powers of a single individual [1]. Nevertheless he did manage to make substantial contributions towards the fulfilment of his design. In 1620 he published, among other things, the unfinished *Novum organum* which belongs to Part Two of the *Instauratio*. In 1623 he published the first part of the *Instauratio*, namely the *De augmentis scientiarum* – a revised, expanded, Latin version of *The advancement of learning* of 1605. From 1622 to 1626 he prepared four natural histories which were intended to illustrate the requirements of the third part of the six-part sequence [2]. In addition, he also produced a number of prefaces, minor pieces [3] and the *Abecedarium*

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[1] For the plan of the *Instauratio magna* see *The Works of Francis Bacon*, 7 vols., ed. J. Spedding, R. L. Ellis and D. D. Heath, London, 1859-1864, 1, pp. 134-145. Also see G. REES, *Francis Bacon's semi-Paracelsian cosmology and the « Great Instauration »*, « Ambix », XXII (1975), pp. 161-173.

[2] *Historia ventorum*, London, 1622; *Historia vitae et mortis*, London 1623; *Sylva sylvarum*, London, 1626; *Historia densi et rari* in *Opuscula varia posthuma*, ed. William Rawley, London, 1658.

[3] See *Works*, 1, pp. 121-145; II, pp. 7-18, 80-83, 309-322, 687-692.

novum naturae for the *Instauratio*. Incidentally, most of the *Abecedarium* disappeared in the seventeenth century but Bacon scholars may like to know that a complete manuscript has recently been discovered in the Bibliothèque Nationale [4].

Now the term *spiritus* and its English derivative 'spirit' occur hundreds of times and in various grammatical forms in works belonging to the *Instauratio*. For instance, Marta Fattori's splendid study tells us that the term crops up no less than 129 times in the *Novum organum* alone. By contrast, the term *experimentum*, a term much more usually associated with Bacon's name, only turns up 108 times in that work [5]. That, as we shall see, is not without significance. In the *Instauratio* the term *spiritus* is used in three senses. In the first place, it refers to supernatural beings: ghosts, demons, angels and the third person of the Trinity, *Spiritus Sanctus*. In the second place, and notably in the *Sylva sylvarum* (1626), Bacon speaks of 'spiritual species'—the incorporeal entities used, medieval fashion, to explain the phenomena of light and sound. The term *spiritus* is used in these first two senses relatively rarely. In the *Instauratio* it is used only 19 times to refer to supernatural agencies and only a handful of times in connexion with the physics of light and sound [6]. So what about the third sense which comprises all the other occurrences of the term? Overwhelmingly in the *Instauratio* and works of earlier date the term *spiritus* denotes

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[4] Fonds français, n. 4745, fols. 39*r*-62*r*. A fragment of the *Abecedarium* was published (from a different manuscript) in *Baconiana, or certaine genuine remains of Sir Francis Bacon*, ed. Thomas Tenison, London, 1679; also see *Works*, II, pp. 85-88.

[5] M. Fattori, *Lessico del « Novum organum »*, 2 vols., Roma, 1980, II, pp. 288-289 (*spiritus*), cf. p. 107 (*experimentum*). In addition (p. 288), there are seven references to forms of *spiritalis* and *spiritualis*. Here, like Fattori, I have used the title *Novum organum* to refer to all the items published in 1620 under the title *Instauratio magna*.

[6] See *Works*, I, pp. 131, 145, 465, 468, 544, 546, 547, 550, 608, 609; II, pp. 425, 428, 435, 556, 572, 643, 657, 658, 680.

a class of corporeal, natural entities which forms the cornerstone of Bacon's theory of matter — a theory upon which he erected the massive structure of his little-known speculative philosophy.

At this point I had better say what the speculative philosophy is or, at least to begin with, what it is not. The speculative philosophy was not the philosophy for which Bacon became famous. As everybody knows, his reputation rests on the ambitious method and programme which aimed to supplant existing systems of natural philosophy with new sciences generated by applying inductive procedures to colossal bodies of scrupulously verified empirical and experimental data. The programme explicitly rejected syllogistic reasoning, the unaided intuitions of the human reason, and knowledge as an end in itself. In fact Bacon's programme held out the prospect of new sciences which would not be static or conservative bodies of knowledge but ones which would grow and increase with the utilitarian aim of progressively improving the material conditions of human race. These new sciences were not to be products of isolated individuals seeking contemplative satisfaction; they were to be products of organised, state-financed, cooperative research directed to the welfare of mankind through the creation of new and powerful technologies [7].

All that is well-known, but it is only one dimension of Bacon's work. In recent years it has become apparent that he devoted considerable effort to another, quite different end. Not only did he develop the method and programme; he also developed a speculative system of positive natural philosophy. This speculative philosophy is not a set of recommendations for rebuilding the sciences but a comprehensive system of explanations of natural phenomena, a system that sought to

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[7] There are many studies of these aspects of Bacon's work but the best is still P. Rossi, *Francesco Bacone: dalla magia alla scienza*, Torino, 1974.

account for the structure, substance and motion of the heavens, for the motions of the winds and tides, the transformations of inorganic bodies, plant and animal physiology, and animal psychology and pathology. In short, Bacon attempted to produce an explanatory system quite as comprehensive as those of Aristotle or Descartes. He worked on this speculative philosophy with great enthusiasm but without the assistance of the inductive method. The speculative philosophy is, in the fashionable phrase, hypothetico-deductive. In constructing it Bacon ignored or even violated the methodological imperatives of the *Novum organum* and he did so in order to produce a provisional model, something to be going on with, pending proper implementation of his programme [8].

As I have said, the little-known, obscure speculative philosophy was erected upon a theory of matter which centres on the notion of *spiritus*. According to Bacon, matter exists in two states. In the first place, there is tangible matter (*corpus tangibile*). This is inactive, dense and immobile stuff. It is found in only one place for it constitutes the globe of the earth which stands stationary at the centre of a finite universe. The rest of the universe is filled with various sorts of *spiritus* and as the *Historia vitae et mortis* (1623) tells us, « Spiritus autem ille (de quo loquimur) non est virtus aliqua, aut energia, aut entelechia, aut nugae: sed plane corpus tenue, invisible; attamen locatum, dimensum, reale ». In other words, *spiritus* is a sort of thin vapour and, above all, it is material and the source of activity in the universe [9].

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[8] On aspects of the speculative philosophy see G. Rees, *Francis Bacon's semi-Paracelsian cosmology*, « Ambix », XXII (1975), pp. 81-101; id., *The fate of Bacon's cosmology in the seventeenth century*, « Ambix », XXIV (1977), pp. 27-38; id., *Francis Bacon on verticity and the bowels of the earth*, « Ambix », XXVI (1979), pp. 202-211; id., *Atomism and 'subtlety' in Francis Bacon's philosophy*, « Annals of science », XXXVII (1980), pp. 549-571.

[9] *Works*, II, p. 213, III, pp. 769-780; also see G. Rees, *Matter theory:*

There are two major classes of spirit in the universe: pure and compound. The pure spirits are air, fire, interstellar ether and celestial fire which is the substance of the planets. Air and ether belong to a family of substances, a family which has two other members: tangible sulphur and oil. This family is called the sulphur quaternion. Likewise celestial fire and common fire join with tangible mercury and water to form a family called the mercury quaternion. Now each member of the sulphur quaternion is capable of forming compounds by joining together with its opposite number or qualitative antithesis in the mercury quaternion. Mercury and sulphur can combine to produce salt; oil and water can come together to form blood, sap and other juices of living bodies; celestial fire and ether join to form the region of the stars. But, most important of all, the terrestrial pure spirits — fire and air — join forces to produce the compound *spiritus* which are the principal agents of change in the terrestrial world [10].

There are two sorts of compound *spiritus*. When air and fire team up and air is the dominant partner, *spiritus mortuales* or inanimate spirits are produced. When fire is the chief partner, *spiritus vitales* or animate spirits are formed. These compound spirits are found in only one place in the universe, within the crust of the earth and the tangible bodies upon it. In fact, these compound spirits are actually trapped or enclosed in the tangible matter that constitutes all the objects of our immediate environment. As one might expect, *spiritus vitales* exist only in the bodies of living plants and animals. *Spiritus mortuales*, however, exist in all bodies, living and non-living. Consequently *spiritus mortuales* coexist with *spiritus vitales* in the bodies of

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a unifying factor in Bacon's natural philosophy? « Ambix », XXIV (1977), pp. 110-125.

[10] *Works*, II, pp. 82-83, 351-352, 476, 485, 536, 543, III, pp. 770-771; also see Rees, *Matter theory*, pp. 115-118.

animals and plants [11]. But, while the *spiritus vitales* are happy to be confined within tangible bodies, *spiritus mortuales* detest their captivity, strive to escape and, in so doing, gradually undermine and destroy the bodies which contain them. Thus the *spiritus mortuales* are the main cause of disintegration in inanimate bodies and of ageing and death in living ones [12]. Nevertheless, the *spiritus mortuales* also have creative functions — but I shall return to those later.

The *spiritus-corpus tangibile* dichotomy first appeared in Bacon's writings in the early 1590s, almost thirty years before the publication of the *Novum organum* [13]. A developed conception of inanimate spirit operating in tangible matter began to emerge from about 1604 [14]. But it is not until much later that the concept of *spiritus vitalis* begins to appear in Bacon's works. In fact, among the published texts the concept is employed in works written from 1620 onwards, in works written in partial fulfilment of the requirements of the plan of the *Instauratio magna*. In these works Bacon used a variety of terms to denote the concept. The expression *spiritus vitalis* and the synonymous *spiritus vivus* are used relatively rarely [15]. For the most part he used the word *spiritus* by itself and left it to the context

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[11] *Works*, II, pp. 214-217, 303, 528.

[12] *Ibid.*, I, pp. 310, 340; II, pp. 112, 119-120, 213-214, 216, 254-255.

[13] See *The letters and life of Francis Bacon*, 7 vols., ed. James Spedding, London, 1861-1864, I, pp. 123-126; also see the record-type transcription *A conference of pleasure composed for some festive occasion about the year 1592 by Francis Bacon*, ed. J. Spedding, London, 1870, p. 14.

[14] See *Cogitationes de natura rerum* in *Works.*, III, p. 27; also see *The advancement of learning*, London, 1605, in *Works*, III, p. 362.

[15] The expression *spiritus vivus* occurs only in the *Historia vitae* and *Historia densi*, see *Works*, II, pp. 203, 206, 207, 225, 254, 255, 256, 277. The expression *spiritus vitalis* occurs in the *Historia vitae* and *Topica inquisitionis de luce et lumine*, see *Works*, II, pp. 107, 126, 214, 215, 216, 322. It also occurs once in *Abecedarium novum naturae*, see manuscript Fonds français n. 4745, folio 55*r*.

to tell us that he had living spirit in mind. He also used the expressions *spiritus animatus*, *spiritus animalium*, and *spiritus humanus*. These expressions simply refer of course to *spiritus vitalis* in particular classes of being; they do not, as some scholars have thought, denote entities different from *spiritus vitalis*[16]. That is also true of a group of terms used only in the *De augmentis scientiarum*, special terms used in the context of a discussion of the differences between human or animal *spiritus vitalis* and human *anima rationalis*. Here Bacon distinguished between, on the one hand, *anima rationalis* and, on the other, *anima sensibilis*, *anima producta*, *anima irrationalis*, *animae brutorum*, *anima inferioris* and *spiritus hominum*[17]. Once again I cannot stress too highly that these terms, *anima sensibilis*, *anima producta* and so forth, refer only to *spiritus vitalis* and nothing else.

Inspection of the published works leads to two related conclusions: that Bacon did not have occasion to invoke the concept of *spiritus vitalis* before 1620 and, consequently, that he did not make any serious attempt to integrate the biological realm into the body of his speculative philosophy before 1620. However, both these conclusions are completely false. They do not take into account evidence furnished by a very important and exciting event – the discovery of an unpublished Bacon manuscript at Chatsworth House. This manuscript makes it unnecessary to suppose that there was an eight-year gap between Bacon's elaboration of the cosmological aspects of his speculative philosophy and elaboration of the biological aspects. The manuscript, designated Hardwick 72A, is a 13,500 – word Latin text entitled *De viis mortis et de senectute retardanda, atque instaurandis viribus*. As the title suggests, the manuscript deals with biological topics and, in particular, with the processes of ageing

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[16] For an instance of the confusion that this variety of terms causes see K. R. WALLACE, *Francis Bacon on the nature of man*, Urbana and London, 1967, pp. 16-17, 32.

[17] *Works*, I, pp. 428, 481, 604-609, 613, 645.

and death, and with means of staving off those evils. In the manuscript the term *spiritus* occurs 26 times in contexts which indicate that Bacon had *spiritus vitalis* in mind. In addition the manuscript employs the semantically equivalent *spiritus in viventibus* twice and *spiritus vivens* once [18]. The available evidence suggests that the manuscript was begun about 1612-1613 and that it was abandoned unfinished at some point before 1618 or 1619. In other words, it is Bacon's earliest extant attempt to produce an extended treatment of biological questions and to formulate the distinction between living and non-living spirits [19]. The publication of the works of the *Instauratio* did not therefore mark the introduction of the concept of *spiritus vitalis*. The concept appears to be a product of the second decade of the seventeenth century and not of the period from 1620 onwards.

So much then for the term *spiritus vitalis*, its semantic equivalents and their distribution within Bacon's works; but what exactly is *spiritus vitalis* and what explanatory functions is the concept called upon to undertake within the framework of the speculative philosophy? To answer those questions we need to look briefly at Bacon's general conception of organic nature. Bacon saw living beings in the terms of a thoroughly traditional, commonplace regulative belief – the belief that the daunting variety of plant and animal species could be viewed as links in a mighty hierarchy or chain of being [20]. His particular version of the chain can be reconstructed in considerable and rather attractive detail from a multitude of scattered references in the *Works*. But I will not attempt a complete reconstruction here;

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[18] Folios 8*v*., 15*r*·, 16*r*., 17*v*., 21*r*., 26*v*., 28*r*.-29*v*.

[19] For the dating and principal themes of this manuscript see G. Rees, *Francis Bacon's biological ideas: a new manuscript source* in *Occult and scientific mentalities in the renaissance*, ed. Br. Vickers, (forthcoming).

[20] For the history of this idea see A. O. Lovejoy, *The great chain of being*, New York, 1936; W. F. Bynum, *The great chain of being after forty years: an appraisal*, « History of Science », VIII (1975), pp. 1-28.

a general outline will suffice. Each living species is assigned a place in the hierarchy according to the relative vitality and structural sophistication of its members. At the bottom of the hierarchy one finds rare quasi-animate beings like coral and vitriol. These beings are neither strictly animate nor altogether lifeless but, in accordance with the Platonic principle of plenitude, they bridge the gap between the inorganic realm and the kingdom of unambiguously living things [21].

The lowest of the unequivocally living things are the imperfect plants. These are imperfect because they lack morphological stability, lack conspicuous vitality and originate not from seed but from putrefaction. Imperfect plants rise from mosses and mushrooms up to the aristocrat of imperfect plants — namely duckweed, which Bacon deemed to be transitional between perfect and imperfect plants [22]. Perfect plants have greater stability of form than imperfect ones, and that stability arises from the fact that they are generated from seed. Above the perfect plants come the imperfect animals which have sensation and motion but, bred from putrefaction, lack the formal stability of perfect animals. The imperfect animals number among their company such unappealing beings as insects, eels, snakes and the like [23].

Of the perfect creatures the lowest are the shellfish. They cling to the bottom rung of the animal being — indeed, hardly that, for they can be regarded as transitional between plants and animals. As Bacon says, « they are fixed and have no local motion of remove ». These oysters will never join the dance and, consequently, they must yield precedence to the more vivacious tribe of horse-mussels which (we are told) « not only gape and shut as oysters do but remove from one place to another ». Above these shifty shellfish come the true fish and

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[21] *Works*, II, pp. 529, 592-593; also see *ibid.*, I, p. 283.

[22] *Ibid.*, I, p. 543; II, pp. 264, 453, 512, 515-516, 529.

[23] *Ibid.*, II, pp. 208-209, 474, 506-508, 516, 547, 557-560, 639.

above them the birds. Next come the quadrupeds which ascend in order to the ape [24]. The ape is the highest of the purely natural links in the chain of being. It is the creature which marks the transition between the quadrupeds and man. Man himself stands at the intersection of the natural and supernatural stretches of the chain for he, like the animals, possesses a material body but nevertheless partakes of the supernatural and eternal because he possesses a rational soul (*anima rationalis*) which is incorporeal and divine (*incorporea est et divina*) [25].

Ascent of the chain is therefore a matter of increasing vitality, stability of form, diversity of internal structure and (in animals) sensory-motor sophistication. However, in the last analysis, the place assigned to a being in the chain depends on the nature of its *spiritus*. *Spiritus* is organised in three ways which correspond to the three major sections of the chain of natural being. *Spiritus* is distributed in discrete portions or in branching channels or in branching channels rooted in a cellular concentration of *spiritus*. Inanimate bodies only possess the first type — the *spiritus mortuales* mentioned earlier. Plants possess *spiritus mortuales* but they also contain *spiritus vitales* organised in branching channels. Animals also possess *spiritus mortuales* and *spiritus vitales* arranged in branching channels but the network of channels or nerves is connected to a body of *spiritus vitalis* located in the cerebral ventricles [26]. Moreover, the higher the organism in the chain of being the more fiery are the *spiritus vitales* and the greater the volume of *spiritus vitales* relative to the body [27]. Among animals the higher the species the greater is the proportion of *spiritus vitalis* concentrated in the cerebral cells. Indeed Bacon asserted that imperfect animals possessed cells so narrow that

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[24] *Ibid.*, I, pp. 283, 543; II, p. 531, 630-631.

[25] *Ibid.*, I, pp. 604-607; II, p. 225.

[26] *Ibid.*, I, pp. 311; II, p. 130, 192, pp. 214-215, 351-352, 528-530.

[27] *Ibid.*, II, pp. 528, 530.

their *spiritus vitales* seemed « rather to be diffused over the body than seated in the cells », but « nobler animals, and men most of all have larger ventricles » [28].

This then is the way in which Bacon attempted to impose theoretical order on the diversity of living forms and to assimilate the chain of being to his speculative philosophy or, conversely, to justify his theory of matter in terms of its capacity for explaining the fact of a natural hierarchy. The bridge between hierarchy and matter theory is the concept of *spiritus vitalis* and *spiritus vitalis* is what confers on living things most of those functions and faculties which inorganic beings lack.

Now Bacon said virtually nothing about the function of *spiritus vitalis* in plants. But he no doubt believed that in plants and in animals *spiritus vitalis* was responsible for the vegetative or involuntary functions of growth, digestion, maintenance and so forth. Certainly he believed that all the organs of living bodies were energised by *spiritus vitalis* for this *spiritus* is the « master-wheel which turns all the other wheels in the body » [29]. But in animals *spiritus vitalis* does more than merely superintend the vegetative functions. Animals have ventricular concentrations of *spiritus vitalis* in the head and because of that the *spiritus* is able to mediate centrifugal motor functions and centripetal sensory ones. These functions flow from the chemistry of the spirit. As we know, *spiritus vitalis* is « compounded of the natures of flame and air ». Consequently it has (according to the *De augmentis*), the « softness of air to receive impressions, and the vigour of fire to propagate its action » [30]. From air the *spiritus* derives (according to the *Historia vitae*) « its easy and delicate impressions and receptions, but from flame its noble and powerful

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[28] *Ibid.*, II, p. 215.

[29] *Ibid.*, II, pp. 215-216, 221.

[30] *Ibid.*, I, p. 606, cf. IV, p. 398.

motions and activity »[31]. In other words, the airy component is the sensory aspect of the *spiritus vitalis*; the fiery component the centrifugal or motor aspect.

The sense organs and the stimuli impinging upon them alter the *spiritus vitalis* in the nerves. The alteration or impression is conducted by the *spiritus* in the nerves to the *spiritus* in the cerebral ventricles where the impression is preserved in the memory which in animals is itself no more than *spiritus vitalis* acting in particular ventricular conditions[32]. As for voluntary motion, its immediate causes are « the compressions, dilatations, and agitations » of the *spiritus* in the nerves and sinews, and the sheer vigour and velocity of the *spiritus* is capable of overcoming the inertia of the bodily mass even « in such huge creatures as the whale or elephant ». However, the efforts of the *spiritus vitalis* in the ' canals of the sinews ' do not constitute the ultimate source of animal locomotion[33]. The ultimate source lies in the ' cells of the brain ' and especially in the imaginative faculty. Bacon believed that any creature capable of voluntary motion must possess imagination. For instance,

> insecta have voluntary motion, and therefore imagination [...] for ants go right forward to their hills; and bees do (admirably) know the way from a flowery heath two or three miles off to their hives.

Sensory images transmitted by the *spiritus* in the nerves are preserved as changes in the *spiritus* in a cerebral ventricle. The sum total of these changes is the memory. To initiate voluntary motion an image stored in the memory must be

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[31] *Ibid.*, II, 225, cf. V, 335.

[32] For Bacon's ideas about sensation see *ibid.*, I, pp. 278, 610-611; II, 389-390, 423, 556-557, 571-572.

[33] *Ibid.*, I, pp. 328, 609; II, 263, 351-352.

transferred to the imagination, which, like memory, is no more than *spiritus vitalis* operating in specific ventricular conditions. The imagination of a bee, for instance, presents it with an image or map of its route to the hive and that image prompts the *spiritus* in the nerves to produce the voluntary responses necessary for the return journey [34].

That is true of insects and animals but is it also true of human beings? Are some at least of the higher human faculties to be regarded as mere ' ripples ' in the *spiritus vitalis*? These are difficult questions and I can only suggest provisional answers here. As we know, Bacon believed that man alone among mortal beings possessed an incorporeal, rational soul and that man's *spiritus vitalis* was a mere instrument of his *anima rationalis*. He also seems to have had no doubt that man's higher faculties belonged to the rational soul. According to the *De augmentis*:

> Partitio Doctrinae Humanae ea est verissima, quae sumitur ex triplici facultate Animae Rationalis, quae doctrinae sedes est. Historia ad memoriam refertur, Poesis ad Phantasiam; Philosophia ad Rationem [35].

However, we learn later in the same work that the study of voluntary motion and imagination in human beings belongs unequivocally to the research field concerned with *spiritus vitalis*. Indeed, Bacon appears to think that human imagination, sensation and voluntary motion operate in much the same way as in animals [36]; so did he believe that human memory and imagination were manifestations of *spiritus vitalis?* Did he believe that these faculties appeared both in the *anima rationalis* and the *spiritus vitalis?* I do not think so. I think that he saw the *anima*

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[34] *Ibid.*, I, pp. 231, 609-610, 615; II, p. 560.

[35] *Ibid.*, I, p. 494.

[36] *Ibid.*, I, pp. 609-615.

rationalis as a supernatural principle informing ventricular concentrations of *spiritus*, concentrations corresponding to the three faculties of memory, reason and imagination. *Anima rationalis* energises these concentrations in ways unique to human beings. Thus, for example, reason would be a particular manifestation of the activity of *anima rationalis* expressed through the motions of *spiritus vitalis* localised in a particular cerebral cavity. A view of this kind is probably what lies behind Bacon's statement that, « Fabrica autem partium, organum spiritus est; quemadmodum et ille animae rationalis » [37]. However, it must be said that the relationship between the human faculties, *anima rationalis* and *spiritus vitalis* requires a fuller examination than I have been able to give here.

Let me now round off this discussion with a few words about how Bacon thought that *spiritus vitalis* came into existence and secondly, about the traditions on which he may have drawn while formulating his ideas about *spiritus*. I said earlier that Bacon distinguished between *spiritus vitales* and *spiritus mortuales*. I also said that the two sorts of *spiritus* coexist in living bodies and that the destructive proclivities of the *spiritus mortuales* ensure the eventual demise of every animate being. But the *spiritus mortuales* also have a creative function. The published works tell us that they detest confinement in tangible matter and that if they can they will escape from it. However in special kinds of tangible matter, for instance the matter of eggs, seminal fluid and rotting flesh, the *spiritus mortuales* cannot easily break out so instead they move about within tangible matter and shape it into an organised body [38]. This is the first stage of vivification; but no body can be alive without *spiritus vitalis* so where does *spiritus vitalis* come from? The published works tell us nothing except that the *spiritus vitalis* springs from the « wombs of the elements (*e Matricibus Elementorum*) »

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[37] *Ibid.*, II, p. 225.

[38] *Ibid.*, I, p. 316; II, pp. 451, 557-558, 638.

— a quasi-Paracelsian formulation which tells us precisely nothing apart from the fact that *spiritus vitalis* is not a supernatural substance [39].

At this point the unpublished Hardwick manuscript comes to our rescue. Only from that text do we learn that *spiritus vitales* are actually elaborated from *spiritus mortuales*. In appropriately sequacious substances some of the discrete pockets of *spiritus mortuales* link up with each other to form continuous channels [40]; and this organisational change, presumably accompanied by simultaneous qualitative changes, produces *spiritus vitales*, the *spiritus* that spark the incipient organic being into life. Life is thus a cyclic process for once an organism has been formed, the unconverted *spiritus mortuales* act in their usual predatory and destructive ways and eventually destroy the conditions necessary for the persistence of the channelled *spiritus vitalis*. When that happens the organism dies, putrefaction sets in, and putrefaction in its turn provides exactly the right sort of matter for the spontaneous generation of new life, for the spontaneous generation of imperfect creatures like mushrooms, flies, worms and other strange, formally unstable fruits of corruption. Putrefaction is, as Bacon puts it, the « bastard brother » of vivification [41]. Death and putrefaction, themselves consequences of the actions of the *spiritus mortuales*, furnish new matter on which those *spiritus* can exercise their creative functions [42].

Finally, let me say a few brief words about the intellectual

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[39] *Ibid.*, I, p. 604. Bacon's use of the Paracelsian metaphor implied no commitment to the Paracelsian doctrine of element-matrices. For the doctrine and Bacon's response to it see REES, *Francis Bacon's semi-Paracelsian cosmology*, cit., pp. 82-83, 89-90.

[40] Folio 26*v*.

[41] *Works*, II, p. 453.

[42] For a fuller discussion of the issues considered in this paragraph see REES, *Francis Bacon's biological ideas* cit., *passim*.

antecedents of Bacon's concept of *spiritus vitalis*. In recent years scholars have become increasingly aware of the variety and importance of the roles played by conceptions of *spiritus* in Renaissance philosophies of nature. In this connexion we owe a particular debt to the distinguished work of, among others, D. P. Walker, Walter Pagel, Allen Debus and Owen Hannaway [43]. In the light of these researches one can see obvious affinities between the Baconian notion of *spiritus vitalis* and Neo-platonic and Paracelsian ideas about the astral body or Galenic theories of medical spirits. For instance when Bacon speaks of the functions of the organs which maintain *spiritus vitalis*, it is difficult to distinguish his ideas from those current in Galenic tradition. That is particularly true of what he has to say about the organs that produce the blood and carry it to the cerebral ventricles where the blood in some way ' repairs ' or ' refreshes ' *spiritus vitalis*. It is also true of the functions that Bacon assigns to *spiritus vitalis* itself [44]. However, I would like to qualify that by suggesting that Bacon's « Galenism » was probably very much modified or informed by his reading of the Italian philosophers Bernardino

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[43] D. P. WALKER, *Spiritual and demonic magic from Ficino to Campanella*, Liechtenstein, 1969; ID., *Francis Bacon and spiritus* in *Science, medicine and society in the Renaissance*, 2 vols., ed. Allen G. Debus, London, 1972, II, pp. 121-130; W. PAGEL, *Paracelsus: an introduction to philosophical medicine in the era of the Renaissance*, Basel, 1958; ID., *Paracelsus and the neo-platonic and gnostic tradition*, « Ambix », VIII (1960), pp. 125-166; A. G. DEBUS, *The chemical philosophy: Paracelsian science and medicine in the sixteenth and seventeenth centuries*, 2 vols., New York, 1977; O. HANNAWAY, *The chemists and the word: the didactic origins of chemistry*, Baltimore and London, 1975.

[44] See *Works*, II, pp. 204-206. For Galen's theories about physiological spirits see R. E. SIEGEL, *Galen on psychology, psychopathology, and the function and diseases of the nervous system*, Basel, 1973. It is also worth pointing out that Bacon's wiews (in so far as they can be established) of the functions of the organs are largely Galenic, see *Works*, I, pp. 232-234; II, pp. 130, 180, 207, 358, 362, 613.

Telesio and Agostino Doni [45]. Indeed, I hope that one day someone will build on the foundations laid by Walker and Assenza [46], and produce a detailed study of Bacon's responses to the Telesian tradition. I suspect that we still have much to learn about this — especially, perhaps, about Bacon's response to Doni's notion of *spiritus* [47].

Nevertheless, source-hunting (though undeniably valuable) has its limits, as does talk about ' influences '. Bacon's idea of *spiritus vitalis* belongs to the mosaic of his matter theory and, in general, that theory is not quite like anything in the works of earlier writers. No matter what the specific affinities or ' debts ', the geography, disposition or spatialization of concepts in Bacon's system are not Galenic, Paracelsian, Telesian or anything else. The concept of *spiritus vitalis* is limited or delimited by adjacent concepts within an overall theory of matter and that theory was a systematic response to or transformation of borrowings of an initially eclectic character. If one wishes fully to understand Bacon's concept of *spiritus vitalis*, one must understand not just its relationship to possible sources but one must try to glimpse the reasons why Bacon thought it natural or rational to pattern or group concepts in the way that he did pattern and group them. It may be a long time before we are properly able to do the latter.

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[45] See *Works*, I, p. 606 « Anima siquidem Sensibilis sive Brutorum plane substantia corporea censenda est [...] quemadmodum Bernardinus Telesius, et discipulus ejus Augustinus Donius, aliqua ex parte non omnino inutiliter asseruerum ».

[46] V. Giachetti Assenza, *Bernardino Telesio: il migliore dei moderni. I riferimenti a Telesio negli scritti di Francesco Bacone*, « Rivista critica di storia della filosofia », XXXV (1980), pp. 41-79.

[47] Doni's physiology of spirits seems, at points, remarkably similar to Bacon's. See L. de Franco, *L'eretico Agostino Doni, medico e filosofo cosentino del '500*. In appendice: *A. Doni - De natura hominis* con traduzione a fronte, Cosenza, 1973, pp. 308-312, 326-332, 348-352.