

# CHEMISTRY AND THE QUEST FOR A MATERIAL SPIRIT OF LIFE IN THE SEVENTEENTH CENTURY

ALLEN G. DEBUS \*

Vitalist philosophies have dominated the sciences throughout most of history. The concept of a 'Spirit of Life' coupled with the macrocosm-microcosm analogy remained a respected basis for explanations of natural phenomena until the dominance of the Mechanical Philosophy in the late seventeenth century and even later. Rattansi has suggested that key aspects of Sir Isaac Newton's physics were based upon an early acquaintance with the *spiritus*<sup>1</sup> while the vitalism of the early nineteenth century *Naturphilosophen* may be linked with the Renaissance nature philosophies<sup>2</sup>. The main points of this story have been dealt with admirably by Marielene Putscher in her *Pneuma*,

---

\* Morris Fishbein Professor of the History of Science and Medicine, The University of Chicago. The present paper is based upon work supported by the National Science Foundation under Grant No. SES-8008919.

<sup>1</sup> P. M. RATTANSI, *Newton's Alchemical Studies*, in Allen G. Debus, editor, *Science, Medicine and Society in the Renaissance: Essays to honor Walter Pagel*, 2 vols., New York, 1972, pp. 167-182.

<sup>2</sup> There is no need to summarize this literature since it is not the subject of the present paper. However, the present author has made some suggestions regarding the connection in *Science vs. Pseudo-Science: The Persistent Debate*, Morris Fishbein Center for the Study of the History of Science and Medicine, Publication No. 1, Chicago, University of Chicago, 1979. In addition, see ALLEN G. DEBUS, *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries* 2 vols., New York, Science History Publications, *in passim*.



*Spiritus, Geist* (1973) which discusses *spiritus* conceptually from theology to science and medicine and chronologically from Greek antiquity to the seventeenth century<sup>3</sup>.

My own comments will do little more than add a few notes to the work of others. Here I will concentrate on the medical and scientific thought of the seventeenth century, especially the work of the Paracelsians and the Chemical Philosophers who sought an understanding of man and nature through chemistry and chemical analogies. For them the 'Spirit of Life' was both real and substantial, something which might be obtained in the form of a concentrate or even isolated in pure form for the benefit of man.

What did *spiritus* mean to a physician or a chemist in the seventeenth century? Its importance may quickly be established by referring to the works of Walter Pagel<sup>4</sup> or to the recent monograph on Fernel and Severinus by Professor Bianchi<sup>5</sup>. And yet, the answer is not a simple one. If we turn to the standard medical lexicon of the period, Bartolomeo Castelli's *Lexicon Medicum*, we are referred from *spiritus* to *pneuma* and led through a series of definitions and usages in medicine, pharmacy, iatrochemistry, alchemy and chemistry<sup>6</sup>. The first cita-

<sup>3</sup> M. PUTSCHER, *Pneuma, Spiritus, Geist: Vorstellung vom Lebensantrieb in ihren geschichtlichen Wandlungen*, Wiesbaden, Franz Steiner 1973.

<sup>4</sup> See especially his *Paracelsus. An Introduction to Philosophical Medicine in the Era of the Renaissance*, Basel, S. Karger, 1958.

<sup>5</sup> M. L. BIANCHI, *Occulto e Manifesto nella Medicina del Rinascimento: Jean Fernel e Pietro Severino*, in *Atti e Memorie dell'Accademia Toscana di Scienze e Lettere* («La Colombaria» XLVII, Nuova Serie XXXIII), Firenze, Olschki, 1982, pp. 185-248.

<sup>6</sup> BARTOLOMEO CASTELLI, *Amaltheum Castello-Brunonianum, Sive Lexicon Medicum, Primum a Bartholomaeo Castello Messanensi Inchoatum ... Cura, & Studio iterato Jacobi Panciatii Brunonis ...*, Padua: Ex Typographia Seminarii apud Joannem Manfrè 1721, p. 624. Castelli's *Lexicon* was published first in 1598 and went through many subsequent editions. The 1721 edition is a reprint of the expanded version of J. C. Bruno first published 1683.



tion is to Hippocrates who spoke of the *pneuma* as an aerial, vaporous substance essential for the constitution of our bodies. The place of the *pneuma* in respiration is illustrated by reference to Galen while note of the operation of the similar nitro-aerial spirit in the body is taken from recent iatrochemical literature.

Castelli noted that for the pharmacist *spiritus* most frequently meant the lightest distillation fraction<sup>7</sup>. At this point we come directly in contact with chemical tradition. The chemical or spagyric art was most frequently defined as the separation of the pure from the impure and distillation was the most common tool of the chemist to effect this separation.

Castelli went on to summarize the various alchemical definitions of *spiritus* to be found in Martin Ruland's *Lexicon Alchemiae* (1612) discussing acidic spirits and internal powers of chemicals. But Castelli distinguished the practical usage of the chemist and the pharmacist from the far more complex world view of the Paracelsians. Although most followers of Paracelsus (1493-1541) were physicians who eagerly adopted the new chemically prepared medicines, they went far beyond this in elaborating an alchemically inspired cosmology that was of little interest to the more practical pharmacist. Thus, Castelli noted that among the Paracelsians and Spagyrist the term *spiritus* was frequently in use, but that its meaning was enigmatic and parabolic<sup>8</sup>. It might often be interpreted as the first principle of natural bodies, but it was also the most subtle substance or the first product of the Creation. Indeed, for some it was to be understood as the 'Spirit of the World' (*Universalis sive Spiritus Mundi*).

This vital aerial Spirit, divine in origin and necessary for all life in a universe in which all things are alive, occurs frequently in the iatrochemical and alchemical literature of the

---

<sup>7</sup> CASTELLI, *op. cit.*, p. 624.

<sup>8</sup> *Ibid.*



sixteenth and seventeenth centuries. It is called by many of these authors a volatile salt or an aerial saltpeter or niter. Indeed, the concept was to persist in corpuscular terminology in the work of John Mayow and other late seventeenth-century mechanists<sup>9</sup>. It is of special interest to us that Robert Fludd attempted to isolate this spirit chemically. This is the main subject of his *Philosophicall Key* which dates from about 1619. But the same concept may also be related to the early analyses of the blood by fire that are so frequently encountered later in that century. The study of the blood involved the distribution of this vital spirit throughout the body, a matter of keen interest to chemists in midcentury who saw medical and cosmological truths dependent upon the Harveyan theory of the circulation.

Let me turn first to Robert Fludd (1574-1637). Because of the wealth of research on this author over the past few decades it is unnecessary to review in any detail his life, his work as a whole, or the many debates he engaged in. Suffice it to say that although he had long been engaged in the writing of his massive volumes on the macrocosm and the microcosm, he had published nothing until 1616 when the attacks of Andreas Libavius on the Rosicrucian texts moved him to reply. His apology was meant to be his own introduction to the supposed brotherhood. More important for us is the fact that here he offered his plan for a new understanding of nature.

The 1617 edition of Fludd's Rosicrucian apology presents a view of education reform and a dream of a new science from which he varied but little over the remaining twenty years of his life<sup>10</sup>. Both here and in the many volumes of the *Utriusque cosmi ... historia* he emphasized the essential nature

---

<sup>9</sup> A. G. DEBUS, *The Paracelsian Aerial Niter*, « Isis » LV (1964), pp. 43-61.

<sup>10</sup> ROBERT FLUDD, *Tractatus apologeticus integritatem societatis de Rosea Cruce defendens*, Lugduni, G. Basson, 1617; see especially pp. 187-190.



of the divine light and the Spirit. For him the Creation had been a chemical separation, but it was the divine Spirit which represented the active agent of the Creator. For all earthly creatures it is the sun that serves as the source of light and life. Its golden beams by the mercy of God are conveyed thorough the air and form the necessary aetherial nutriment for all life. There can be no doubt, he wrote, that « the elementarie aire is full of the influences of life, vegetation, and of the formall seeds of multiplication, forasmuch as it is a treasure-house, which aboundeth with divine beams, and heavenly gifts »<sup>11</sup>. We must seek the relation of this Spirit to life and microcosmic investigations are to be focused on its assimilation in the body. He noted that all animated beings require air which contains the aetherial Spirit and its divine inner light. Even all generation is from air which has been thickened into the form of sperm.

A matter of special significance for Fludd was the determination of the way in which this celestial balsam or quintessence nourished our body. Fludd's understanding of this process was ultimately based upon Galenic physiology although there are Hermetic and chemical overtones<sup>12</sup>. The spirit of the air is attracted through inspiration to the lungs and from there is carried to the heart. The precious occult portion of this quintessence is there separated from the rest — chemically — and then dispersed circularly through the arterial system as the

---

<sup>11</sup> ROBERT FLUDD, *Mosaicall Philosophy: Grounded upon the Essentiall Truth or Eternal Sapience*, London, Humphrey Moseley, 1659, p. 163.

<sup>12</sup> Fludd's concept of the blood flow has been discussed by the present author in *Robert Fludd and the Circulation of the Blood*, « Journal of the History of Medicine and Allied Sciences », XVI (1961), pp. 374-393 and *Harvey and Fludd: The Irrational Factor in the Rational Science of the Seventeenth Century*, « Journal of the History of Biology » III (1970), pp. 81-105. Its importance was noted first by Walter Pagel in *Religious Motives in the Medical Biology of the XVIIth Century*, « Bulletin of the Institute of the History of Medicine » III (1935), pp. 97-128, 213-231, 265-312.



vital spirit. The grosser part of the quintessence is thickened and then joined to the venous blood for the conservation of the entire body. The importance of this spirit cannot be questioned since «the ocular proof [...] is that neither animal, nor vegetable, nor mineral could live, last, or exist for one minute of an hour without this lucid fire»<sup>13</sup>. It is important that for Fludd the Spirit served as the basis for an understanding of all life and that its study in the microcosm had to be linked with the study of the blood flow because this was the essence of the vital spirit of Galenic physiology. And while Fludd is best known as an Hermetic mystic here he spoke not only of divine Revelation, but of the need for observational evidence.

After publishing this Rosicrucian apology Fludd found himself accused of heresy and attacked at Court. He replied to his critics in a short *Declaratio brevis*, and the much longer *Philosophicall Key*, both of which have been published for the first time during the past decade<sup>14</sup>. It is his *Philosophicall Key* that I turn to now because here is to be found his experiment on wheat which is his attempt to isolate the spirit of life.

The *Philosophicall Key* was a reply to those who had attacked his philosophy by calling it spurious and innovative. They were wrong, he argued, because he had based his work on Holy Scripture and philosophical authority. Now he must proceed to support his views «by easy and familier and ocular demonstrations, the very pointing finger of experience, Which is able to instruct the rude and rustical, yea and very fooles them selues»<sup>15</sup>. This was to be an «experimental Treatice»,

<sup>13</sup> FLUDD, *Tractatus apologeticus*, p. 190.

<sup>14</sup> W. H. HUFFMAN and R. A. SEELINGER, JR., *Robert Fludd's 'Declaratio Brevis' to James I*, «Ambix» XXV (1978), 69-92. *Robert Fludd and His Philosophicall Key: being a Transcription of the manuscript at Trinity College, Cambridge with an Introduction by Allen G. Debus*, New York, 1979.

<sup>15</sup> FLUDD, *Philosophicall Key* [op. cit.], p. 70.



no less than an « Oculer demonstration, opening and decyphe-  
ring a great deale of the hidden mysterys of Nature, partly by an  
experimental Conclusion, as also by an intellectual specula-  
tion »<sup>16</sup>. In short, it seemed necessary to depart somewhat from  
the more lofty level of his philosophical description of the ma-  
crocosm and the microcosm to prepare an answer in the lan-  
guage of the common man and to use observational evidence  
to support his views — seemingly more necessary now than  
when he had written for philosophers alone.

Throughout the introductory sections Fludd underlined  
the importance of the divine Spirit. All three kingdoms of nature  
are dependent on it for life and we see its source in the sun  
which we observe daily circling us and sending « her glittering  
vertue perifically » so that « all things might be equally adorned  
and vivified by the influence of her beams ».

In like maner also ruleth she the actiue & panting tabernacle  
to wit the hart in the lesser world, distributing his vitall spirits  
circularly, as from a vertuous centre to the circumference thereof  
by the streaming vessells of arteryall channells<sup>17</sup>.

How wonderful it would be to locate the dwelling place  
of this Spirit in man ! This would mean an investigation of the  
arterial blood. But the same spirit must be responsible for  
vegetable and mineral growth and might be sought in these  
kingdoms as well. The search gave promise of the discovery  
of great truths — truths which would permit the faithful  
operator to « behould and perceauce all the secret mysteris of  
Nature »<sup>18</sup>. Knowledge of the properties of this spirit would  
reveal how the world was made, the powers of the elements,

---

<sup>16</sup> *Ibid.*, p. 63 [title page].

<sup>17</sup> *Ibid.*, p. 91.

<sup>18</sup> *Ibid.*, p. 92.

<sup>19</sup> *Ibid.*, p. 109.



the beginning and the end of time, the nature of all living things, and, indeed, an understanding of «all things both secret & knowne»<sup>19</sup>.

Unwilling to investigate arterial blood, Fludd argued for the suitability of wheat as a source for the isolation of the vital spirit. Some had referred to wheat allegorically as the second person in the Trinity while for others it was the true 'universal spirit'. There seemed little doubt that through its study the chemist would find the reason for its growth. This process was outlined by Fludd in chemical terms. It begins with the putrefaction of the seed. This releases the elements while the actual growth of the plant also involves an elemental differentiation. Here the quintessence (identified with fire) rises in the stalk and becomes concentrated in the wheat grain. Through systematic magnetism the most spiritual part of the plant then attracts to itself more of the aerial spirit. The grain of wheat is then a natural concentrate of the spirit which we seek to study<sup>20</sup>.

In his search Fludd believed that he was merely imitating nature. There is no need to try to recreate the chemistry of the process. In abstract form it began putrefaction, thus imitating the natural growth of the seed. The final goal was the isolation of a «white christalline spirit» which Fludd identified with the desired universal spirit of life. The various steps are complicated and difficult to follow. It would be well to keep in mind that for Fludd these operations had allegorical meaning that did much to explain the macrocosm and man. Thus, the initial putrefaction had resulted in a black, formless matter that could be likened to the initial chaos which he identified with the *prima materia* of the adepts. At a later stage

---

<sup>20</sup> Discussed by DEBUS, *ibid.*, pp. 33-38. For an attempt to understand the process in terms of modern chemistry, see C. H. JOSTEN, *Robert Fludd's 'Philosophicall Key' and His Alchemical Experiment on Wheat, «Ambix»*, X (1963), pp. 1-23.



condensation revealed a bright light that was compared to the Spirit of the Lord moving on the waters. And the final white crystalline spirit was none other than a pure and divine volatile salt of wondrous properties.

That Fludd's final product was the object of his search was established through a series of observations. Its potential for growth was shown by the fact that the residue after separation of the salt developed saffron colored needles on the outside of an iron pot cover<sup>21</sup>. And on standing, the white, clear spirit changed in color to ruby red, thus proving its sympathy or magnetic attraction for the active fire from the sun<sup>22</sup>. Even more dramatic were his observations on the wash water from one of his chemical vessels. After standing a few days he observed the water swarming with worms<sup>23</sup>. For him this was an example of generation that could be ascribed to the trace amount of spirit still remaining in the water.

The experiment might also lead to a better understanding of the human body and further the search for more potent medicines. The chemist who revealed the presence of the four elements in the matter of wheat might also hope to determine which part — or element — of wheat is used for the nourishment of the different parts of the body. Fludd believed that he already knew the answer<sup>24</sup>. The earthy part of the plant is directed to the guts or entrails, the lighter fractions are destined for more noble purposes, while the most subtle, vital part of the air is destined for sanguification.

The transfer of the elements of wheat to their corresponding organs in the human body is important, but Fludd knew that a practicing physician would have other interests. He believed that wheat offered the promise of great healing power

---

<sup>21</sup> FLUDD, *Philosophicall Key*, p. 124.

<sup>22</sup> *Ibid.*, p. 125.

<sup>23</sup> *Ibid.*, p. 138.

<sup>24</sup> *Ibid.*, pp. 97-98.



because its quintessential spirit binds together otherwise opposed elements in our bodies<sup>25</sup>. He argued that disease results from an insufficient quantity of this balm of nature which may readily be obtained from wheat. All cures are thus theoretically possible by what may be characterized as a 'universal cure'. However, although a prominent physician himself, Fludd made little effort to test his belief<sup>26</sup>.

The wheat experiment served Fludd as the basis for his great folio volumes on the macrocosm and the microcosm since he saw herein the key to the Creation and to all parts of the universe. The experiment was repeated largely intact in Latin translation in the *Anatomiae amphitheatrum* (1623) and was referred to in detail in the *Medicina Catholica* (1631) as well as the posthumous *Philosophia Moysaica* (1638)<sup>27</sup>.

### *Blood Analyses by Fire: Van Helmont and Boyle*

Fludd claimed to have isolated a spirit with wonderful properties with his experiment on wheat — and he was convinced that his white crystalline salt was the Spirit of life to be found in the arterial system. We need not then be too surprised to note that contemporary iatrochemists — drawing upon the same conceptual background — expressed interest in the distillation of the blood. And if their goal was not always to isolate a salt, they were surely concerned with the determination of the chemical components that were present.

We might turn first to Fludd's younger contemporary, Jean-Baptiste van Helmont (1579-1644). He, too, referred to

---

<sup>25</sup> *Ibid.*, pp. 32-33.

<sup>26</sup> Fludd cured himself of an ache in his hand with this balm (*ibid.*, p. 99), but he gave no other cases of its medical use.

<sup>27</sup> These references are discussed by the present author *ibid.*, pp. 40-43.



wheat and blood for evidence of a life force. In the first instance — here discussing the seminal archeus and the ferment — he described the generation of mice from wheat and a dirty shirt over a three week period<sup>28</sup>. But more important for us is van Helmont's discussion of the blood. In a number of tracts, the most important being the *Spiritus vitae* and the *Aura vitalis* that were published posthumously in the *Ortus medicinae* (1648), van Helmont wrote of the vital spirit in the blood and proceeded to discuss its analysis.

In a method reminiscent of Fludd, van Helmont turned to Scriptural authority. There 'life' — which he compared to fire and light — is contained in the arterial blood<sup>29</sup>. Van Helmont's understanding of the blood flow was essentially Galenic and there is nothing in his work that indicates an acquaintance with the work of Harvey<sup>30</sup>. Thus the chyle is the origin of both the urine and the venous blood, and the latter through contact with an indrawn aerial spirit is converted to the arterial blood<sup>31</sup>. One could then say that «the vitall Spirit Is arterial Blood resolved by the force of the Ferment and Motion of the Heart, into a salt Air being vitally enlightened»<sup>32</sup>.

---

<sup>28</sup> JEAN-BAPTISTE VAN HELMONT, *Imago Fermenti impraegnata massam Semine* (sects. 8, 9) in *Ortus medicinae. Id est initia physicae inaudita. Progressus medicinae novus, in morborum ultionem, ad vitam longam*, Amstelodami, Ludovicus Elzevir, 1648; Reprinted Brussels: «Culture et Civilisation», 1966, pp. 112-113. *Oriatrike or Physick Refined. The Common Errors therein Refuted, and the whole Art Reformed & Rectified. Being a New Rise and Progress of Philosophy and Medicine, for the Destruction of Diseases and Prolongation of Life*, trans. J(ohn) C(handler), London, Lodowick Loyd, 1662, p. 113.

<sup>29</sup> VAN HELMONT, *Custos errans*, sec. 2, *Ortus*, p. 259; *Oriatrike*, p. 255.

<sup>30</sup> Evident throughout, but see as an example the *Aura vitalis*, *Ortus*, p. 727; *Oriatrike*, pp. 734-735. Here the vital spirit is discussed in terms of a Galenic framework.

<sup>31</sup> *Spiritus vitae*, sec. 12, *Ortus*, pp. 197-198; *Oriatrike*, p. 194.

<sup>32</sup> *Aura vitalis*, *Ortus*, p. 728; *Oriatrike*, p. 734.



However, it was not enough for van Helmont, «to have known that the venal Blood doth ascend into the arterial Blood» and that the «arterial Blood passeth over, partly into vital Spirit, and partly departeth into the Nourishment of the solid Parts»: it also «behoves us to have known the Marrow of the vital Spirit»<sup>33</sup>. To find this essence, van Helmont, like Fludd, turned to analysis by fire. Rather than attempting to isolate the 'quintessence' of wheat as had Fludd, van Helmont turned to human blood<sup>34</sup>. Noting the common origin of urine and venous blood, he examined each in turn. From urine a volatile salt spirit is obtained which when fermented with the earth produces saltpeter. The venous blood also contains a volatile salt spirit which is the same as the spirit of urine except that «the Spirit of the Salt of Venal Blood cureth the Falling-sickness, but the Spirit of the Salt of Urin not so»<sup>35</sup>. Thus, although the two salt spirits were similar, a curative property was ascribed to the volatile salt of blood and this distinguished it from the spirit of urine. It is not uninteresting that both the 'spirits' from blood of van Helmont and Fludd should exhibit medical properties.

For van Helmont there was a great mystery in the relationship of the venous to the arterial blood and to the vital spirit. He was convinced that the vital spirit must be saltlike and aerial in nature. As for the change of the venous to the arterial blood, van Helmont suggested that the «venal Blood may be homogeneally transcharged by the Ferment of the Heart».

[...] the salt Spirits, and Sulphur of the arterial Blood do by the Pulse, rub themselves together in the Sheath of the Heart, and a formal Light together with Heat, is kindled in the vital Spirit; from the Light I say, of the most inward, and implanted sunny

<sup>33</sup> *Aura vitalis*, *Ortus*, p. 726; *Oriatrike*, p. 733.

<sup>34</sup> *Ibid.* See also *Spiritus vitae*, sects. 15-16, *Ortus*, pp. 198-199; *Oriatrike*, p. 195.

<sup>35</sup> *Aura vitalis*, *Ortus*, p. 726; *Oriatrike*, p. 733.



Spirit, in which is the Tabernacle of the specifical Sun, even unto the Worlds end<sup>36</sup>.

Van Helmont's very typical insistence on the existence of 'life' in the blood was partially responsible for his very unorthodox rejection of bloodletting<sup>37</sup>. Any loss of the vital principle could be equated with a corresponding loss in strength and vitality of the body. This theme was adopted quickly by his followers and was to become one of the characteristic aspects of Helmontian iatrochemistry.

The work of van Helmont on the blood is reflected and amplified in Robert Boyle's (1627-1691) *Memoirs for the Natural History of Humane Blood* (1684)<sup>38</sup>. There seems to be little doubt that Boyle was well aware of the analyses of blood made by his contemporaries, Malpighi and Needham, and he would surely have also known of Robert Hooke's (1678) corpuscular description of the blood. However, the *Memoirs* indicate that Boyle was most interested in the chemical process of analysis by distillation. This method had already found avid supporters among Boyle's friends and associates [Thomas Willis, 1659; Walter Needham, 1675]. Like them, Boyle had found five chemical principles in human blood through distillation<sup>39</sup>, but he felt that the chief of these was 'Spirit' and to this he assigned marvelous properties. As a medicine it might be

<sup>36</sup> *In sole tabernaculum*, *Ortus*, p. 782; *Oriatrike*, p. 796.

<sup>37</sup> *De febribus*, Ch. 4, *Opuscula*, pp. 72-25; *Oriatrike*, pp. 949-957. The subject has been covered intensively by P. H. NIEBYL in *Galen, Van Helmont, Blood Letting, Science, Medicine and Society in the Renaissance*, ed. Allen G. Debus, 2 vols., New York (« Science History Publications ») London, Heinemann 1972, II, pp. 13-23.

<sup>38</sup> The influence of van Helmont's blood analyses has been touched on by A. R. HALL in *Medicine in the Royal Society, Medicine in Seventeenth Century England*, ed. Allen G. Debus, Los Angeles/Berkeley, University of California Press, 1974, pp. 421-452.

<sup>39</sup> ROBERT BOYLE, *Memoirs for the Natural History of Human Blood*, 1684 in *The Works of the Honourable Robert Boyle*, 6 vols., London, J. and F. Rivington et al. 1772, IV, pp. 595-659, (610).



administered internally as van Helmont had suggested in his *Spiritus vitae* <sup>40</sup>. However, in the Paracelsian tradition of both Fludd and van Helmont it was important for Boyle to identify this spirit further. Numerous tests were described. Its magnetic affinity for air is stressed. Also of interest is the « putting together [of] the volatile salt of human blood, and the spirit of nitre, with the more fugitive parts of which salt they conceive the air to be plentifully, and some of them to be vitally impregnated » <sup>41</sup>. In this case there was observed the strong smell of niter after heating, not surprising perhaps, but still worth noting because of the traditional identification of the vital spirit with an aerial nitrous salt. But Boyle followed van Helmont in observing that this volatile salt of the spirit of blood was very similar to the spirit of urine <sup>42</sup>. Having raised the question of this relationship, he did not turn to his laboratory for clarification. Rather, he felt confident in offering van Helmont's solution to the problem, that the spirit of the blood and the spirit of the urine are in fact different. No further examination seemed necessary and here as elsewhere in his work may be seen the strong influence of the Belgian chemist.

*From the Microcosmic Circulation to the Macrocosm*

Although interest in the aerial spirit by mechanists declined late in the seventeenth century, we find its reappearance with some authors in corpuscular form. Thus, the Paracelsian aerial niter was reinterpreted in the form of nitroaerial particles by John Mayow and his contemporaries. Late seventeenth century Paracelsians made a point of integrating new discoveries into their own conceptual framework. Here we might

---

<sup>40</sup> *Ibid.*, p. 642.

<sup>41</sup> *Ibid.*, p. 607.

<sup>42</sup> *Ibid.*, p. 623.



refer briefly to several who expressed an interest in the spirit of the blood and its passage through the body.

Robert Fludd had been the first to publish in defence of Harvey's *De motu cordis*<sup>43</sup>. We may differentiate sharply between Harvey's work and that of Fludd, but for the latter, Harvey's experimental treatise only seemed to prove his own, earlier, statements on the circularity of the vital spirit in the arteries. Indeed, the superiority of Fludd's work to Harvey's was underlined by John Webster, a Helmontian chemist, as late as 1654, when he spoke highly of both, but then went on to note that Harvey's discovery was only an application of vulgar anatomy which had contributed little to the curing of disease. It is, he wrote, « defective as that vive and *Mystical Anatomy* that discovers the true *Schematism* or signature of that invisible *Archeus* or *Spiritus mechanicus* [...] of which *Paracelsus*, *Helmont*, and our learned Countreyman, Dr. *Fludd*, have written most excellently »<sup>44</sup>. In short, Harvey's work may have been justly renowned, but Robert Fludd's works represented a more penetrating analysis of the world as a whole. His mystical anatomy of the blood surely seemed to Webster to offer a far more profound understanding of the subject than did the more superficial anatomical work of Harvey.

And if van Helmont never referred to Harvey or to the circulation of the blood, other chemists rejoiced in the discovery since they, like Fludd, saw in it the experimental discovery

<sup>43</sup> See the references above, note 12.

<sup>44</sup> JOHN WEBSTER, *Academiarum examen, or the Examination of Academies. Wherein is discussed and examined the Matter, Method and Customs of Academick and Scholastick Learning, and the insufficiency thereof discovered and laid open; As also some Expedients proposed for the Reforming of Schools, and the perfecting and promoting of all kind of Science. Offered to the judgements of all those that love the proficiencie of Arts and Sciences, and the advancement of learning*, London, Giles Calvert, 1654, p. 74. Reprinted with the replies of Seth Ward and Thomas Hall in ALLEN G. DEBUS, *Science and Education in the Seventeenth Century: The Webster-Ward Debate*, London, Macdonald and New York, American Elsevier, 1970.



of cosmic truths. Thus, Tobias Schütz reflected Fludd's work in a text on the macrocosm and the microcosm published in 1654. Of special importance to him was the recent discovery of the circulation of the blood which for him confirmed the harmonic relationship of the great and small worlds <sup>45</sup>. Not long after this, William Simpson paused to note in a work on mineral waters (1669) that watery circulations in the geocosm are as necessary for maintaining the symmetry of the earth's globe «as the Circulation of the blood is necessary for the preservation of life, and vital functions in the Microcosme or body of man» <sup>46</sup>.

Far more important was Johann Rudolph Glauber whose interest in the mysterious vital spirit was no less than that of Fludd. He, like other Paracelsians, was convinced that air was required for all forms of life. The spontaneous generation of live maggots required air: it did not occur in glasses that were hermetically sealed <sup>47</sup>. Nor could metals live without the spirit of life. As Fludd and vanHelmont had done before, Glauber sought to identify and to isolate this spirit. He assumed a heavenly source and speculated that it originated in the sun. By exposing flat dishes filled with an unidentified 'magnetic' solution to the sun he claimed to have isolated this precious substance <sup>48</sup>. The absorbed sunbeams produced a concentrated solution which upon evaporation yielded a salt. This proved to be saltpeter, or *sal nitrum*, which Glauber called the *Miraculum mundi* and the universal solvent <sup>49</sup>.

<sup>45</sup> TOBIAS SCHÜTZE, *Harmonia macrocosmi cum microcosmo. Das ist/ Eine Übereinstimmung der grossen mit der kleinen Welt als dem Menschen/in zwei Theil abgetheilet*, Frankfurt am Main, Daniel Reicheln, 1654, pp. 26-27.

<sup>46</sup> WILLIAM SIMPSON, *Hydrologia chymica: or the Chymical Anatomy of the Scarbrough, and other Spaws in York-Shire*, London, 1669, pp. 303-304.

<sup>47</sup> JOHANN RUDOLPH GLAUBER, *The Prosperity of Germany*, Part 4, [Des Teutschlands Wolfahrt] in *The Works of The Highly Experienced and Famous Chymist, John Rudolph Glauber...*, trans. Christopher Packe, London, Thomas Milbourn, 1689, Part 1, p. 389.

<sup>48</sup> *Ibid.*, p. 390.



Glauber emphasized the importance of aerial niter which he believed originated in the stars and then, through the medium of the air, impregnated rain, snow, and dew. This, in turn, fructified the earth<sup>50</sup>. Indeed, *sal niter* was so important that Glauber felt that the Emerald Table of Hermes was basically a commentary on this substance. Our very lives are preserved through the hidden virtues of this salt. But because that which maintains life is the aerial *spiritus universalis*, the vital aerial spirit must be the familiar aerial niter<sup>51</sup>.

If this spiritous salt is freely available to man and best through respiration, there is no reason why an analogous circulatory system would not benefit the living metals in the earth since these, too, required a supply of the life-giving salt.

Seeing therefore, that the constant Circulation of Blood in the *Microcosm*, can be in no wise deny'd, why should not also such a Circulation in the *Macrocosm* be admitted as true? For as the Blood of the Human Body arising from the Liver, diffuseth it self through all the Passages and Veins of the Body, [...] and conserveth the life of the whole, [...]. So also is it with the Nutriment and Universal Aliment of the great World, while the Salt water without intermission [...] passeth through all the parts of the Earth, and nourisheth and sustaineth them with its Salt [...] <sup>52</sup>.

Thus, arguing from the now generally accepted microcosmic circulation of the blood, Glauber went on to accept an analogous circulation of the life spirit within the earth. This circulation is essential for the birth of minerals as well as life-giving salts at the surface of the earth.

---

<sup>49</sup> GLAUBER, *Of the Nature of Salts* in the *Works*, Part 1, p. 442; *Spagyric pharmacopea*. See especially the preface to Part 3 printed in the German *Opera Chymica, Bücher und Schrifften*..., Francofurti ad Moenum Thomas-Matthiae Götzens 1658-1659, I, p. 97.

<sup>50</sup> GLAUBER, *Miraculum mundi* in the *Works*, Part 1, p. 169.

<sup>51</sup> *Ibid.*, p. 170.

<sup>52</sup> GLAUBER, *Of the Nature of Salts* in the *Works*, Part 1, pp. 248-249.



*Conclusion*

This paper has touched on only a few points illustrative of the deep interest in the blood and the spirit of life in the seventeenth century. We readily admit that many of these topics should be examined in greater detail, but we may still draw a few general conclusions. We know that in the late sixteenth and early seventeenth centuries a number of Paracelsians had given considerable attention to the vital spirit of the air which they were eventually to refer to as a vital nitrous salt. For Robert Fludd the concept of a material, aerial, and vital salt was to become essential to his interpretation of the universe and his *Philosophicall Key* did, indeed, discuss his search for this spirit in wheat. For Fludd the growth of this plant could be compared with the divine Creation while at the same time the alchemist could repeat the entire process and be rewarded not only with divine knowledge, but also with the invaluable material life spirit.

Fludd had insisted that the spirit of life is identical in all three kingdoms. For this reason the spirit isolated from wheat would be the same as that found in the blood of man or any other living creature. It is of special interest then to note early work carried out on the blood. Van Helmont placed great emphasis on the concept of a vital spirit present in the arteries and he noted the medicinal value of the salt prepared from venous blood. In the case of Boyle reference to a vital life spirit was to take second place to his distillations and chemical examinations of the spirit. For Boyle as with van Helmont and Fludd the spirit of the blood retained medicinal properties of great importance.

The analyses of blood carried out by Boyle and his contemporaries have been discussed recently by Audrey Davis. She has pointed out their importance in the acceptance of the concept of the blood as a chemical fluid. This combined with (a) the rejection of the traditional humors and (b) Glisson's belief



that the blood contained its own power of sanguification led to the belief that 'blood diseases' might be treated directly by the infusion of chemicals. At this stage we are far removed from the Paracelsian chemistry with which we began, but in fact Boyle and Willis were influenced by van Helmont, and the same concept of a vital spirit requisite for life that had influenced him had resulted in Fludd's experiments on wheat.

If we are to understand seventeenth-century thought in this field it is useful to think not only in terms of the microcosm, but also, as did Fludd, of the macrocosm. He believed that the chemical investigation of the spirit might lead not only to medical advance, but also to a greater knowledge of the universe as a whole. We have seen this not only in Fludd's defence of Harvey, but in a series of authors culminating in Glauber who accepted the circulation of the blood as proven and then used this as proof of greater circulations in the geocosm and the macrocosm.

For most of our authors, salt, niter, and saltpeter were interchangeable terms, but the fundamental subject for all was an essential vital spirit. By the end of the century this *spiritus* was seldom referred to in the scientific academies of Europe, but it must be remembered that then as now there were many interested in nature who did not form part of the establishment. There were, indeed, many eighteenth century scholars who continued to study the works of the Renaissance alchemists and Paracelsians. Further examination of this concept in the Enlightenment may well contribute to our understanding of the relationship of Renaissance mysticism with the science and medicine of the Romantic period<sup>53</sup>.

---

<sup>53</sup> A. G. DEBUS, *The Paracelsians in Eighteenth Century France: A Renaissance Tradition in the Age of the Enlightenment* « Ambix » XXVIII (1981), 36-54 and *Alchemy and Paracelsism in Early Eighteenth Century France in Renaissance Transition: Essays in Memory of Frances A. Yates*, edited by Ingrid Merkel and Allen G. Debus [Associated University Presses (Folger Series), in press].