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5

Graham Rees assisted by Christopher Upton

Francis Bacon's Natural Philosophy: A New Source.

A transcription of manuscript Hardwick 72A
with translation and commentary

The British Society for the History of Science

FOR

Emma Lucy Elizabeth Rees

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PREFACE AND ACKNOWLEDGMENTS

The heart of this monograph is an annotated transcription of MS Hardwick 72A. This manuscript, lodged at Chatsworth House, contains a hitherto unpublished treatise by Francis Bacon. The treatise, entitled *De viis mortis*, is undoubtedly the longest and most important natural-philosophical text by that writer to have been discovered since the seventeenth century. From a textual point of view it is the most complex in the Bacon canon.

The transcription is, of course, the most important part of this study and no effort has been spared to ensure that it is as full and accurate as possible. The transcription is accompanied by a facing-page translation and supported by an extensive commentary which deals with the dating, provenance, and contents of the manuscript. Responsibility for the transcription and commentary rests with me. The translation, however, is the result of cooperative effort; and in that connexion I owe a special debt of gratitude to my collaborator, Dr Christopher Upton. He traced some of the sources of Bacon's literary allusions and offered valuable suggestions for improving the transcription. But, above all, he helped me turn a very rough initial translation into what we believe to be a satisfactory rendering of Bacon's Latin. In that difficult task Chris Upton's scholarship, attention to detail and unfailing good humour proved to be indispensable.

I am indebted to Nancy Siraisi and the late Walter Pagel for expert advice on the medical-historical background of Bacon's ideas; and to Charles Schmitt who read and commented on portions of this monograph in draft. I must also place on record a number of general debts: to Paolo Rossi whose modernisation of Bacon studies (see ch. 2, note 1) did so much to awaken my interest in Bacon's philosophy; to D. P. Walker whose seminal work (see ch. 5, notes 30-1) on the key concept of *spiritus* has had an abiding influence on my research; and to Marta Fattori whose excellent lexical study of the *Novum organum* ("*Lessico del Novum organum di Francesco Bacone*", 2 vols., Rome, 1980) was a constant companion while I was preparing and annotating the transcription.

I wish to express my gratitude to the Chatsworth librarians, Peter Day and Michael Pearman, whose courteous efficiency helped me in so many ways; to the Trustees of the Chatsworth Settlement for permission to publish the transcription; and to Peter Beal who made the discovery from which this monograph originated.

Finally my warmest thanks to Roger Smith and Christine Nightingale. Roger Smith's scrupulous and indefatigable editorial supervision helped me in countless ways; Christine Nightingale's expertise conjured a splendid typescript from my appalling handscript.

Graham Rees, 1984

The commentary

1 Introduction

(a) The manuscript: description, dating and provenance

While researching for the monumental Index of English literary manuscripts, Peter Beal put us in his debt by discovering a number of unpublished manuscripts (1) by Francis Bacon (1561-1626). The most important of these is the longest Latin manuscript of Bacon's that has come to light since the seventeenth century (2). Designated MS Hardwick 72A, it is lodged at Chatsworth House, the unassuming country *palazzo* of the Duke of Devonshire. The manuscript consists of thirty leaves each measuring 90 cms x 30 cms; it runs to some 13,500 words, and deals with a topic close to Bacon's heart - the prolongation of life. It provides us with important information about his 'biological' ideas and the wider theoretical framework to which they belong (3).

In Beal's Index, the Hardwick manuscript is treated as two separate items. The first item (BcF 294) is written in continuous prose; it runs from folio 1 verso to folio 8 recto, and bears the title *De viis mortis, et de senectute retardanda, atque instaurandis viribus*. The second bears the cancelled title *Aphorismi de dissolutione rerum quae fit per aetatem in inanimatis et consistentibus* and is made up of a series of aphorisms, lists, and other discontinuous prose passages. It runs from folio 8 verso to folio 30 verso and is listed as item BcF 287 in Beal's Index (4). However, it is my belief that these two items do not constitute separate works; rather they constitute parts of a single text in which the continuous prose section serves as an introduction to much of the material which follows it.

But it is not enough to distinguish between the two items which Beal took to be separate works. For the purposes of analysis the manuscript must also be divided in another way, into two parts which represent two or more stages (5) in the evolution of the unfinished text. The first part (which I shall call Part A) runs from folio 1 verso to folio 15a recto (6). This part comprises the continuous prose introduction and some of the aphoristic material. It was drafted as a fair copy by one of Bacon's amanuenses (whom I shall call the Hardwick amanuensis) but the copy bears scrawled revisions (some of them extensive) in Bacon's hand. The second part (Part B), written entirely in Bacon's difficult hand, runs from folio 16 recto to folio 30 verso. I shall demonstrate that much of Part B was

written as a series of revisions and additions which Bacon intended to be incorporated into a reworked and rearranged version of Part A. I shall also try to determine (as far as possible) the sequence in which materials in Parts A and B were meant to be fitted together. But before turning to these matters, I would like to deal with the questions of dating and provenance.

To assign a date or dates to the Hardwick manuscript is no easy matter. Ideally, one would like to know when the Hardwick amanuensis drafted Part A, when Bacon revised Part A, and when he wrote Part B; but there are no simple answers to these questions. In the first place it cannot be assumed that Part B, which is full of evidence of changing plans and intentions (7) was written during a single interval. In the second, it appears that Bacon's Part A revisions were not carried out at the same time; some were made before Part B was far advanced, others were made later (8). In the third place, even if we knew when the amanuensis produced the fair copy, we might still not know when Bacon produced the original draft of Part A, the draft from which the amanuensis worked.

The implications of this last problem are all too apparent if one looks at another task which the Hardwick amanuensis did for Bacon. He made copies of five of his employer's civil and moral tracts, copies which now constitute the British Library manuscript Harley 1893. The uniformity of ink, paper, and watermarks suggests that the copies were made as a single task executed in a relatively short time (9). The latest of the tracts, the memorial which Bacon wrote following the death (1612) of Henry, Prince of Wales, was composed in or about 1613 (10). So the copies must have been made after that date. Yet the earliest tract in the Harley manuscript, An advertisement touching the controversies of the Church of England, was originally written in 1591 (11). Since the amanuensis copied that tract at least a quarter of a century after its composition, it is obviously a possibility that his contribution to the Hardwick manuscript could have been made long after the composition of the original from which he worked.

However, I have not mentioned the Harley manuscript merely to underline the obvious. The links between the Harley and Hardwick manuscripts are interesting in themselves. Although one has one watermark throughout and the other a different one, both consist of paper manufactured at Basle by the Heusler firm (12), and both absorbed the labours of the same amanuensis - so perhaps the one was produced not long before (or after) the other. But further progress with this line of inquiry will have to await the results of a long-term photographic and beta-radiographic survey of Bacon manuscripts, and that survey is far from completion (13). All the same, the exiguous evidence of some chronological link between the Harley and Hardwick manuscripts looks a lot stronger when it is associated with some remarkable evidence furnished by the Hardwick

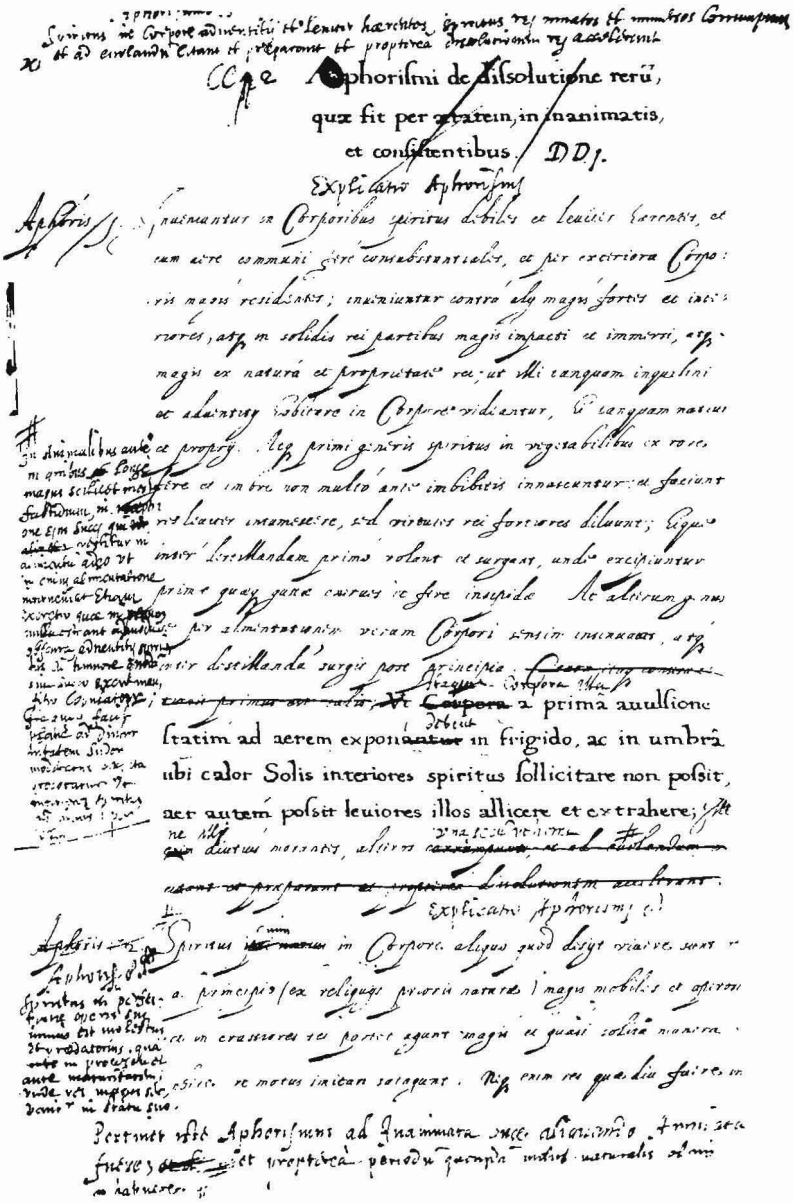


Plate 1. Fol.8v. Fair copy drafted by the amanuensis; revisions in Bacon's hand. (Reproduced by kind permission of the Trustees of the Chatsworth Settlement.)

manuscript itself.

In the manuscript, *De viis mortis* begins on folio 1 verso. Folio 1 recto is covered by an extra leaf gummed over it. This leaf bears a copy in an unidentified hand of a eulogy of Bacon by George Herbert (14). So what, if anything, is written on folio 1 recto? In strong light the superimposed leaf turns out to be obligingly translucent and it yields up its crucial secret: that folio 1 recto carries a copy of the final 175 words of the *De fluxu et refluxu maris*, a copy written in the hand of the Hardwick amanuensis. The copy begins at the top of the page in the middle of a sentence ('*solum de temporibus sive horis ...*') and ends with '*... quam ipsas aquas*', the closing words of the text in the Spedding edition (15). Not only is it possible that a complete copy of the *De fluxu* once preceded the *De viis mortis* manuscript (16), but it is certain that all the material in the latter must have been written after the composition of the former. The *De fluxu* was not as many scholars seem to believe, written in 1615 or 1616. It was written in 1612 or, more probably, the year before that. The Hardwick manuscript must therefore belong to the period after about 1611 (17).

Bacon perhaps wrote the lost original of Part A at some point during that surge of activity which produced the *De fluxu*, *Phaenomena universi* (c1611), *Descriptio globi intellectualis* (1612), and *Thema coeli* (1612) - works which testify to theoretical preoccupations closely allied to those of the *De viis* (18). The amanuensis then made a copy of the original no earlier than 1611 and probably not much later than 1612 - a date consistent with the hesitant conclusions based on the evidence of links between the Hardwick and Harley manuscripts. Bacon subsequently revised the Part A copy and wrote Part B. This work may have been carried out intermittently and over a considerable period (19). Indeed internal evidence suggests that some of the material in Part B may have been written quite some time after the unrevised Part A copy - at some time nearer, perhaps, to (say) 1618 than 1612 (20).

However, it is almost impossible to believe that any part of the manuscript was written *after* the end of the decade in which it was begun. In the first place, certain technical terms used regularly by Bacon in the years from 1620 do not occur in Part B of the manuscript at those points where one might expect them to occur (21). In the second, much of the material in the manuscript would have been superseded by the works of the *Instauratio magna*, works published between 1620 and 1626. Particularly relevant here are the *Novum organum* (1620) and *Historia vitae et mortis* (1623) (22). Finally, there is no reference to *De viis mortis* or anything like it in Rawley's list of the works written by Bacon after 1619. That list appeared in the biography (23) which William Rawley (1588?-1667) produced in 1657. Now Rawley was Bacon's chaplain and secretary

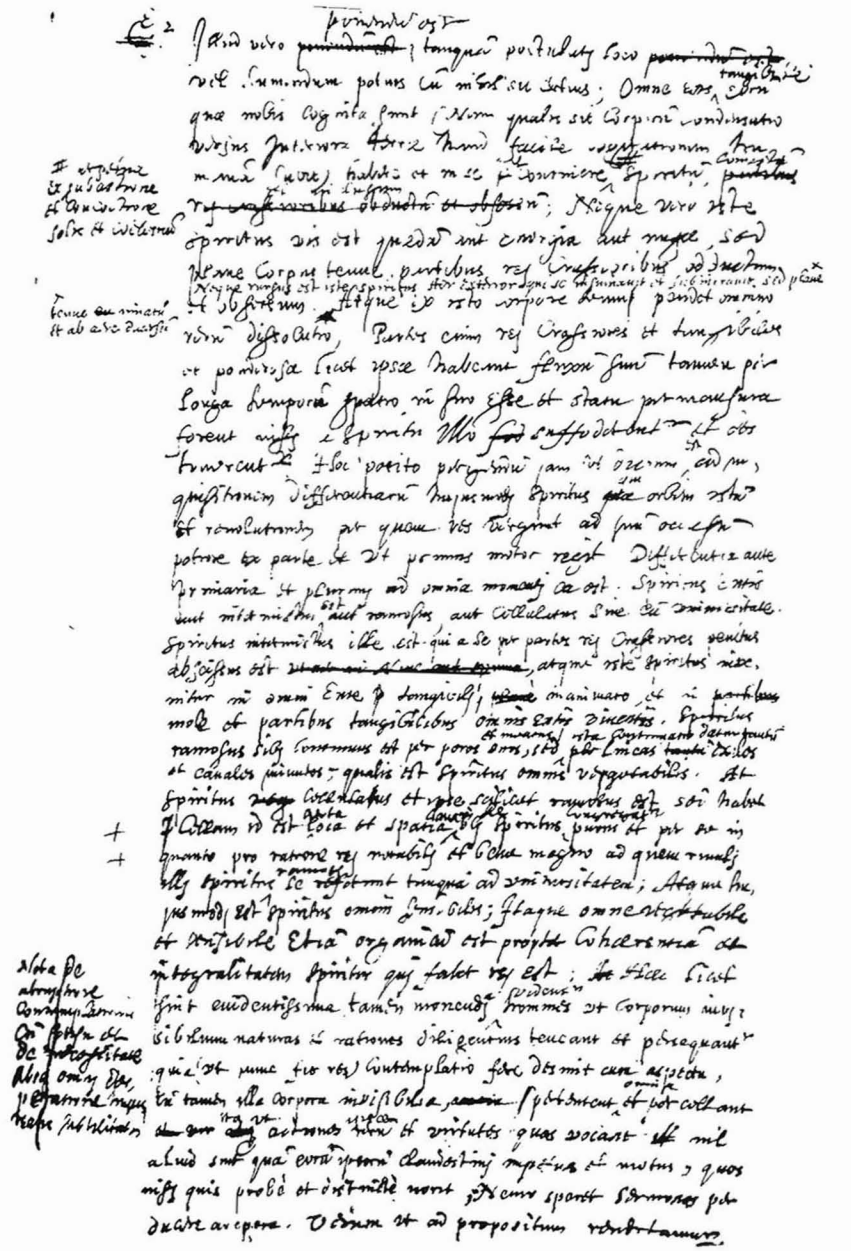


Plate 2. Fol.16r. Bacon's hand. (Reproduced by kind permission of the Trustees of the Chatsworth Settlement.)

from 1618 until his patron's death in 1626; he published and preserved a number of Bacon's manuscripts, and generally devoted much pious effort to Bacon's memory and literary legacy (24). If the *De viis mortis* had belonged to the years after 1619, it is difficult to believe that Rawley would have omitted it from his list - a conclusion strengthened by the fact that the list mentions not just the published works but missing, fragmentary or unpublished ones as well (25).

To recapitulate: Bacon may have written the original draft of Part A c1611-1612. This draft, no longer extant, was copied by the amanuensis in or not long after 1611. Bacon then revised Part A and wrote Part B; these tasks were probably carried out intermittently and over a long period, and the manuscript was abandoned unfinished at some time before 1620.

The history of the manuscript in the years after Bacon decided to abandon it is largely unknown. It is unlikely that it left his keeping before his death. He tended to hang on to manuscripts even when he had abandoned them or when their contents had been superseded or incorporated in other works (26). If he wished to send manuscript materials to friends, he invariably had fair copies made for that purpose. In theory, he could have sent the Hardwick manuscript to his friend William Cavendish, 1st Earl of Devonshire (d1626) and ancestor of the manuscript's present owner (27); but it is not easy to believe that Bacon would have thought it fit for any save his own eyes or those of his unfortunate assistants. Despite the elegant contribution of the amanuensis, the manuscript is too untidy, disorganised and downright unreadable for one to suppose that Bacon ever circulated it.

After Bacon's death many of his manuscripts passed to Rawley and William Boswell (d1649). As we know, Rawley never mentioned the *De viis mortis* and even if he did inherit it, neither he nor Archbishop Tenison (1636-1715), who inherited Rawley's Bacon manuscripts, published it (28). Alternatively, if it had come into Boswell's hands, the manuscript would probably have been taken to the Continent and, eventually, published (29). If it is unlikely that the manuscript went to Rawley or Boswell, where did it go? That question cannot be answered with any certainty. It could have passed into unknown hands and been bought later by one of the enthusiastic Cavendish collectors (30). But I suspect that the manuscript may have travelled by a more direct route - that it came into the possession of the Cavendish family via Thomas Hobbes (1588-1679). Hobbes was one of Bacon's secretaries and he certainly worked for some twenty years as tutor to William Cavendish, later 2nd Earl of Devonshire (1591?-1628) and to William, later 3rd Earl (1617-1684). I suspect that Hobbes may have acquired the manuscript directly or indirectly from Bacon either for himself or a member of the Cavendish

family. However, at present, this conjecture cannot be substantiated (31).

(b) Revision upon revision

The Hardwick manuscript is a mess. It is a horrible tangle of cancelled and reinstated drafts, revisions, revisions of revisions, interpolations, and changes of plan. Bacon tended to produce his works by a process of successive revisions and, as William Rawley once remarked, brought them to perfection 'as many living creatures do lick their young ones, till they bring them to their strength of limbs' (32). Nowhere can the truth of this remark be seen more strikingly than in the *De viis mortis*; and nowhere is it more apparent that there was a lot of hard licking still to be done.

The task of sorting out the mess is intricate; it may interest Bacon specialists, but other readers may wish to skim through the rest of this chapter and, if necessary, refer back to it later. As I said earlier, I intend to show that the materials in Part B are all products of an incomplete attempt to revise and expand Part A. Some of these materials were meant to be incorporated in the text of Part A; some were meant to follow Part A as continuations of the same work, and some were working notes which testify to Bacon's efforts to decide on a final order for the various items in both parts. I also intend to establish, as far as I can, the order in which these items would have appeared had the revision been completed. Other (more 'local') revisions will be dealt with in later chapters.

Part A has two sections: the introduction in continuous prose which runs from folio 1 verso to folio 8 recto, and the series of aphorisms (fols.8v-15a r). Both sections carry Bacon's revisions. When the amanuensis copied the aphorisms, he numbered them consecutively (1-7) in the left margin. The numbers were subsequently deleted when Bacon decided to rearrange them. Part B consists of drafts in Bacon's hand. There are seventeen of these, and they are as follows:

1. A lengthy passage of continuous prose (fols.16r-18v).
2. A list of aphorism titles (fol.19v).
3. Another list of aphorism titles (fol.20r).
4. Yet another list of aphorism titles (fol.20v).
5. A six-line paragraph: '*Neque tamen* ...' (fol.21r).
6. A sixteen-line paragraph: '*Neque vero* ...' (fol.21r).
7. A draft of '*Aphorismus* 1' with its *explicatio* (fol.22r).
8. A draft of '*Aphorismus* 6' with its *explicatio* (fol.23r).
9. A draft of '*Aphorismus* 9' with its *explicatio* (fol.24r).

10. An early version of item 7 (fol.25r).
11. A draft of '*Aphorismus* 2' with its *explicatio* (fol.26v).
12. A draft of '*Aphorismus* 5' with its *explicatio* (fol.27r).
13. A draft of '*Aphorismus* 6' with its *explicatio* (fols.27r-v).
14. A passage which begins '*At animatorum* ...' (fol.28r).
15. A revised version of item 14 (fols.28v-29v).
16. A revised version of the last section of item 15 (fol.29v).
17. A list of aphorism titles (fol.30v).

I shall deal with the non-aphoristic items (1,5,6,14,15,16) first. I shall then try, with the aid of the lists of aphorisms (items 2,3,4, 17), to establish the intended order of the aphorisms of Parts A and B.

The first of the Part B items listed above is the long passage of continuous prose that runs from folio 16 recto to folio 18 verso. This turns out to be a revised, expanded and systematised version (33) of material in the continuous prose introduction to Part A (fols.5v-8r). There can be no doubt about this. Bacon endorsed the original version with an 'E' at the beginning and with 'AA2' at the end. At the beginning of the revised version we find the endorsement 'E2' and, at the end, 'AA1'. The only reasonable interpretation of these endorsements is that the material between 'E2' and 'AA1' was designed to slot in between 'E' and 'AA2' and displace the earlier version. On the same principle, item 6 in the list above (fol.21r) which is endorsed 'BB2' at the beginning and 'CC1' at the end, was no doubt written for insertion after 'BB1' at the very bottom of folio 8 recto and before 'CC2' at the top of folio 8 verso. Unlike item 1, this insertion would not have supplanted any material in Part A.

In the six-line paragraph on folio 21 recto (item 5), Bacon stressed the provisional nature of the doctrines advanced in the *De viis mortis*. There is nothing to show exactly where this paragraph was to have stood, but it would doubtless have made an appropriate conclusion to any major section of the work, or transition between any two such sections. As for items 14,15 and 16, they are drafts and revisions of a single passage. That passage was probably meant to serve as an introduction to an unwritten section of the work. The *De viis mortis* is as it stands almost exclusively concerned with factors causing the disintegration of inanimate and animate bodies alike; Bacon had intended to move on to discuss factors exclusive to animate beings (34) but never did so - except for those items which I take to be drafts towards an introduction to that unwritten section.

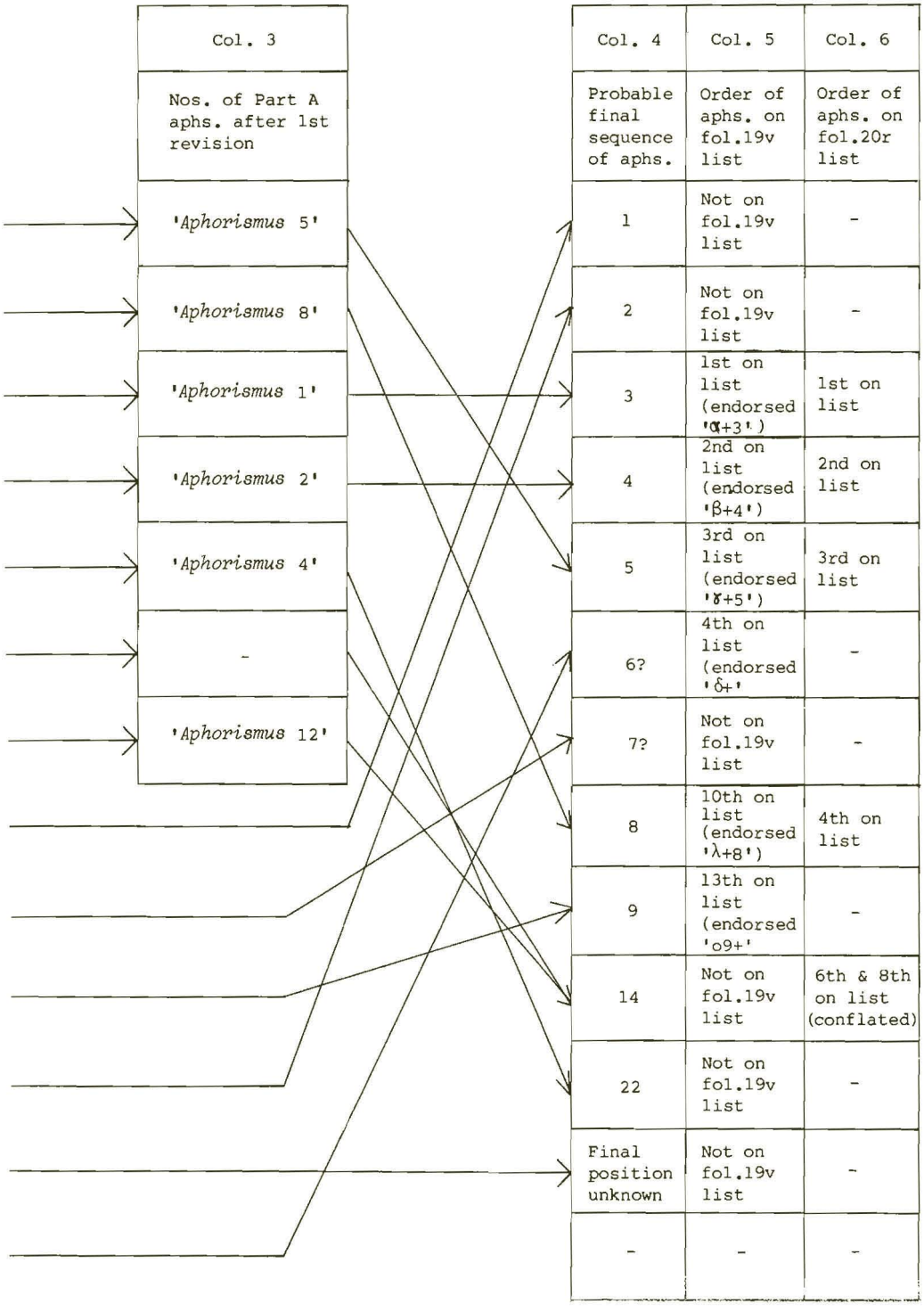
Turning now to the aphorisms of Part B (items 7-13 in the list above), these were meant to be combined with the aphoristic material of Part A (fols.8v-15a r). Now Bacon had already revised the amanuensis' copy of the Part A aphorisms *before* he set about writing the Part B drafts. In the copy, the aphorisms were, as I have said, numbered consecutively (1-7) in the left margin (see Table 1, col.2). When Bacon went over

the copy he deleted these numbers, assigned new ones and changed the wording of the aphorisms. The new numbers indicate, of course, that Bacon meant to change the order of the aphorisms and, since the number sequence had gaps, to add further aphorisms to the text (see Table 1, col.3). He also set the new numbers in the text (not in the margin) and interpolated the word '*explicatio*' (together with its aphorism number) between each aphorism and the explanation attached to it. At a later stage he wrote the Part B aphorisms with their '*explicationes*' with the idea of inserting them among the Part A aphorisms whose sequence he intended to change (yet again) to accommodate the newcomers. These manoeuvres do not help one to divine the probable final order of these items, and the difficulties are compounded by two facts: that Bacon evidently planned to write more aphorisms than actually appear in the manuscript (35), and that he had apparently not made up his mind about the final position of at least one aphorism actually drafted (36).

Now we can make some sense of this palimpsest of shifting intentions and of the problem of the relationships between the aphorisms of Parts A and B, if we start by making a simple but seemingly arbitrary assumption: that the first two aphorisms in the final order were to be the ones numbered '1' and '2' in Part B, *not* the ones which Bacon had numbered '1' and '2' in Part A (fols.9v-10v) when he first altered the amanuensis' copy (see Table 1, col.3). Two arguments favour this assumption. In the first place, the two Part B aphorisms and their *explicationes* systematically set out the first principles of the matter theory on which the doctrines of *De vitis mortis* are based and so they would serve as a proper introduction to the other aphorisms. As Bacon himself said at the end of the draft of the second of these two aphorisms, '*Isti autem duo aphorismi nil aliud sunt quam fundamenta jacta in genere ad sequentes aphorismos qui de dissolutionem rerum proprie tractant*' (fol.26v). Certainly these two aphorisms present principles more general and fundamental than any of the other aphorisms, aphorisms '1' and '2' of Part A included (37). In the second place, a cancelled title ('*Aphorismi de dissolutione ...*') stands just above the point where (if my initial assumption were granted) aphorism '1' of Part B would have stood in the final order (38). It cannot be a coincidence that what seems to be that very title (this time uncancelled) stands immediately above the draft of aphorism '1' in Part B (39).

Arguments for the priority of these two aphorisms would of course be wonderfully strengthened if it could be shown that Bacon meant to demote aphorisms '1' and '2' of Part A (see Table 1, col.3) and relocate them at some identifiable point further down the order. In fact there is strong evidence for just such a demotion. On folio 19 verso there is a list which seems to indicate the sequence of the aphorisms which Bacon meant to adopt in the final version of the work (see Table 1, col.5). The sixteen aphorisms listed are labelled consecutively with Greek letters (α-σ). The key point about this list is that some of the items are also numbered. All the numbered items (save one) appear as full drafts with their *explicationes* elsewhere in the manuscript. The

	Col. 1 The aphorisms in order of their appearance in the MS	Col. 2 Nos. assigned to Part A aphorisms before revision
PART A	'*Spiritus in corpore adventitii ...*' (fol.8v)	1
	'*Spiritus in perfectione ...*' (fol.8v)	2
	'*Quo spiritus in corpore ...*' (fol.9v)	3
	'*Spiritus in corpore ...*' (fol.10v)	4
	'*Spiritus inclusus ...*' (fol.11v)	5
	'*Spiritus emissus ...*' (fol.12r)	6
	'*Spiritus evolans ...*' (fol.13v)	7
PART B	'*Aphorismus* 1' '*Omne ens tangibile ...*' (fol.22r)	
	'*Aphorismus* 6' '*Spiritus acris ...*' (fol.23r)	
	'*Aphorismus* 9' '*Spiritus non ...*' (fol.24r)	
	'*Aphorismus* 2' '*Spiritus in ...*' (fol.26v)	
	'*Aphorismus* 5' '*Spiritus paucus ...*' (fol.27r)	
	'*Aphorismus* 6' '*Spiritus qui ...*' (fol.27r)	



Col. 3
Nos. of Part A aphs. after 1st revision
'*Aphorismus* 5'
'*Aphorismus* 8'
'*Aphorismus* 1'
'*Aphorismus* 2'
'*Aphorismus* 4'
-
'*Aphorismus* 12'

Col. 4	Col. 5	Col. 6
Probable final sequence of aphs.	Order of aphs. on fol.19v list	Order of aphs. on fol.20r list
1	Not on fol.19v list	-
2	Not on fol.19v list	-
3	1st on list (endorsed 'α+3')	1st on list
4	2nd on list (endorsed 'β+4')	2nd on list
5	3rd on list (endorsed 'γ+5')	3rd on list
6?	4th on list (endorsed 'δ+'	-
7?	Not on fol.19v list	-
8	10th on list (endorsed 'λ+8')	4th on list
9	13th on list (endorsed 'ο9+'	-
14	Not on fol.19v list	6th & 8th on list (conflated)
22	Not on fol.19v list	-
Final position unknown	Not on fol.19v list	-
-	-	-

of the sequence of ...

number sequence begins with '3' and runs up to '9'. The numbers 1 and 2 do not appear on the list at all, nor does any reference to aphorisms '1' and '2' of Part B. However, the aphorisms which Bacon had designated '1' and '2' in Part A when he revised the amanuensis' copy for the first time do appear and they appear at the head of the list. They are endorsed 'α+3' and 'β+4' on the list (see Table 1, col.5). In other words, when Bacon wrote the list he meant aphorisms '1' and '2' of Part A to come first in a revised order. He then changed his mind, drafted aphorisms '1' and '2' of Part B, and indicated the change of mind by inserting the figures on the list to show that the two Part A aphorisms were now to be placed third and fourth in the final order - the same positions, incidentally, which they had occupied in the amanuensis' copy before it had been subjected to any revision (see Table 1, col.2). However, in the text itself, the superseded numbers (fols.9v, 10v) were left uncancelled (see Table 1, col.3). But that does not affect the argument since, in the text and in accordance with the folio 19 verso list, Bacon helpfully inserted the endorsement '3α' in the margin next to what, at an earlier stage, he had designated '*Aphorismus* 1' (fol.9v).

If we are right about the final order of the four aphorisms considered so far, then where were the other nine in Parts A and B to stand? Both parts contain an aphorism designated '*Aphorismus* 5'. These two are quite different, so which was meant to stand in fifth place in the final order? Given that the figures in the folio 19 verso list seem to represent the final order, '*Aphorismus* 5' of Part B cannot be considered a likely candidate (see Table 1, cols.1 and 3). The number associated with the full draft of that aphorism was cancelled at some stage (40), and the aphorism does not appear in the list. Indeed, there is no evidence to show where this aphorism would have stood in the final order. However, '*Aphorismus* 5' of Part A does appear in the list where it is labelled 'γ+5' and where it stands immediately after item 'β+4' (Table 1, col.5) - after, that is, the item which would as we have seen, have come fourth in the final order. The supposition that the Part A '*Aphorismus* 5' would have stood in fifth position is strengthened to the point of certainty when we notice that the full text of the aphorism has a small 'γ' entered next to it in Bacon's hand (41).

There are two candidates for sixth position; both are designated '*Aphorismus* 6' and belong to Part B. The stronger candidate appears on folio 27 recto. It is mentioned in the folio 19 verso list between items 'γ+5' and 'ε+7' where it is endorsed 'δ+'. No arabic numeral is associated with the endorsement - of which more in a moment. The intended position of the weaker candidate (fol.23r) is less clear. It may have been destined for seventh position. However, the item endorsed 'ε+7' in the list does not correspond to any aphorism or *explicatio* drafted elsewhere in the manuscript. In addition, the *explicatio* of the weaker candidate was only numbered '6' after Bacon had cancelled an earlier '7' (see Table 1, cols.1 and 5). The

cancellation may indicate some indecision on Bacon's part and that may account for the fact that he did not insert a '6' after the 'δ' on the folio 19 verso list.

At all events, the presence of a '7' cancelled or not, suggests that Bacon had considered placing the weaker candidate in seventh position. There is some evidence for this conclusion. The full text of the aphorism has a trefoil mark associated with it (fol.23r). This mark occurs twice elsewhere in the manuscript - in association with the two aphorisms which were probably destined for the eighth and ninth positions in the final order. These two aphorisms are the ones designated '*Aphoris*.8' in Part A (fol.8v) and '*Aphorismus* 9' in Part B (fol.24r). In the folio 19 list, these two are labelled 'λ+8' and 'o9+' respectively. Since the evidence for the final positions of these is strong, and since both have a trefoil mark associated with them, it would seem reasonable to suppose that the problematic '*Aphorismus* 6' (fol.23r) with its trefoil mark was meant to stand with or near the eighth and ninth aphorisms and in all likelihood, in seventh position - though it may be that Bacon had not made up his mind about this when he abandoned the manuscript.

The final order (see Table 1, col.4) proposed for the items mentioned so far is, I believe, a fair reflection of Bacon's intentions insofar as they can be ascertained. The order concurs with the substance of the aphorisms, with numbers and markings in the manuscript and, broadly, with the folio 19 verso list. It also concurs with the order of items in another, shorter list on folio 20 recto (see Table 1, col.6) - a list which also helps us to place two aphorisms not yet considered. The first of these had originally been numbered '6' in the amanuensis' copy (fol.12r). It was later endorsed '*ad Aph*.14' in the left margin by Bacon. The second (fol.13v) was designated '*Aphorismus* 12' when Bacon revised the amanuensis' draft but was subsequently endorsed '*Ad* 14' in the margin. This suggests that Bacon meant these two aphorisms to be conflated and presented as the fourteenth aphorism in the final order. This conclusion seems firmer when a further fact is taken into account: that the folio 20 verso list contains a conflation of the titles of these very aphorisms - a conflation which appears in the appropriate position in the list (see Table 1, col.6).

One final problem remains, and that relates to an item designated '*Aphorismus* 4' in Part A (fols.11r-12r). Since another aphorism was to have stood in fourth place in the final order (see Table 1, cols.4 and 5), where was '*Aphorismus* 4' to have gone? The answer is provided by the endorsement '*Ad Aph*.22' in the margin next to the draft (fol.11r). One need not be surprised that it should have had so high a number assigned to it. In the various lists of aphorisms in Part B (42) there are some twenty-three aphorism titles, some of which appear on more than one list and which refer to items which do not appear as full drafts (i.e. with *explicationes*) elsewhere in the

manuscript. In other words, if we take these titles together with the aphorisms actually drafted, there would have been at least thirty-five aphorisms in the *De viis mortis* - had the manuscript been completed. In fact there may well have been many more. All the aphorisms drafted in full in the manuscript deal with processes of disintegration common to animate and inanimate beings. Bacon had, of course, intended to proceed further and consider processes which operated only on living things (see fols.28r-29v). Had he realised his intention he would probably have written many more aphorisms on that subject. Indeed, it is possible that he actually wrote more material than appears in this manuscript. In Part B there are a number of cancelled drafts endorsed '*descr.*' (43). The endorsement is probably an abbreviation of '*descriptum est*', meaning that the drafts had been transcribed or copied out in some manuscript that was to supersede the extant text. Perhaps another, later version of the *De viis mortis* once existed. Perhaps in this version the transcribed drafts were built into a fair copy of a fully revised, and more complete text than the one that has survived.

In conclusion it should be said that the Hardwick manuscript is unique among Bacon's writings. Evidence concerning his reworking of material on a small scale can be gleaned by comparing manuscript drafts of sections of the *Sylva sylvarum* with the published text (44). Some understanding of his ways of recasting early works for new purposes can be acquired by comparing the *De augmentis scientiarum* (1623), the enlarged, Latin, 'Ramist' version of The advancement of learning (1605) with the latter, and with the unfinished *Descriptio globi intellectualis* (1612) (45). But none of these texts carries the elaborate, perplexing, and convoluted *internal* revisions of the *De viis mortis*. No other Bacon manuscript shows with such immediacy how he assimilated earlier deposits of thought to the results of continued intellectual activity. No other manuscript shows him in the very act of coping with the organisational changes that followed from such activity. It is fortunate that he was fairly meticulous in signalling his changes of intention; otherwise much of this very curious document would have been more resistant to interpretation than it turned out to be.

Notes to Chapter 1

1 P. Beal, "Index of English literary manuscripts 1450-1625: Parts 1 & 2", Vol. I, London, 1980, pp.48-9. Besides the manuscript with which this study is concerned, Beal discovered an unknown manuscript containing a version of the *Historia densi et rari*, an unknown work entitled *Historia et inquisitio de animato et inanimato*, and the complete text of the *Abecedarium novum naturae*. Before this manuscript (*Bibliotheque Nationale, fonds francais* no 4745) was discovered only a

small fragment of the *Abecedarium* was known; see J. Spedding, R. L. Ellis & D. D. Heath (eds.), "The works of Francis Bacon", 7 vols., London, 1859-1864, II, 85-8. An account by G. Rees of the contents of the *Bibliothèque Nationale* manuscript will appear when the papers delivered at the Francis Bacon colloquium (Rome, 1984) are published. Beal (op. cit. p.48) also discovered a collection of Bacon's working notes (British Library, Add. MSS 38693, fols.29r-52r). For a transcription of and commentary upon these see G. Rees, 'An unpublished manuscript by Francis Bacon: *"Sylva Sylvarum"* drafts and other working notes', Ann. Sci., 1981, xxxviii, 377-412.

2 Of the Latin manuscripts published for the first time in the Spedding edition, op. cit. (1), all are shorter than the one transcribed below. For manuscripts discovered since Spedding: Beal, op. cit. (1), pp.17-24; B. Vickers (ed.), "Essential articles for the study of Francis Bacon", Hamden, Conn., 1968; reprinted London, 1972, pp.xxi-xxiii.

3 See chs. 3 and 4.

4 Beal, op. cit. (1), pp.48-9.

5 See ch. 1, sect. b.

6 Beal's numbering omits the leaf after folio 15. I have designated the omitted leaf folio 15a.

7 See ch. 1, sect. b.

8 Loc. cit.

9 For paper and watermark evidence see ch. 1, sect. a.

10 British Library Harley MSS 1893, fols.75-6; also see Bacon,"Works", VI, 319-25.

11 British Library Harley MSS 1892, fols.5-11; also see J. Spedding, "The letters and life of Francis Bacon", 7 vols., London, 1861-1874, I, 74-95. The other three tracts in the Harley manuscript are: 'A confession of faith' (fols.1r-4v), 'Certain articles or considerations' (fols.18r-31v), 'Answers to questions touching the office of constables' (fols.76v-79v).

12 The Hardwick watermark is a cockatrice rampant perched on the Heusler rebus. The Harley watermark is a cockatrice with wings outspread perched above the Heusler monogram. For published copies of very similar watermarks see P. Heitz, *"Les filigranes avec la crosse de Bâle"*, Strasbourg, 1904, pp.xxviii-xxix; C. M. Briquet, *"Les filigranes: dictionaire historique des marques du papier"*, 4 vols., reprinted New York, 1966, I, facsims.1370, 1383; E. Heawood, "Watermarks mainly of the 17th and 18th centuries", Hilversum, 1950, facsims.834, 842.

13 The aim of this survey is to establish, if possible, when Bacon wrote works which scholars have so far been unable to date with any accuracy. In this connexion we need to know how Bacon's handwriting changed with time, when this or that amanuensis was working for him, and whether he used paper from different sources at different times during his career. It might also be valuable if correlations could be established between these variables.

14 The person who copied the eulogy ascribed it to 'Gulielmus Herbert' - perhaps the William Herbert (1580-1630) who became 3rd Earl of Pembroke. However, the poet is undoubtedly George Herbert (1593-1633). In the copy the poem is entitled *'In honorem illustrissimi D. D. Verulamii Vicecomitis Sti. Albani, Magni Sigilli Custodis post editam ab eo*

Instaurationem magnam'. The poem is printed in the modern edition of Herbert's writings: F. E. Hutchinson (ed.), "The works of George Herbert", Oxford, 1959, pp.436-7. Hutchinson had seen the copy in the Hardwick manuscript: see note p.436.

15 See Bacon, "Works", III, 60-1. The fragment of the *De fluxu* is not recorded in Beal's "Index", op. cit. (1). The fragment is the only extant one to have been copied on Bacon's instruction or under his supervision.

16 Perhaps after the putative copy of the *De fluxu* was separated from the text of the *De viis mortis*, a new copy of the final page was added to the former which may then have found its way via William Boswell (dl649) to Isaac Gruter who first published the work. We know that Gruter worked from original manuscripts 'bearing marks of revision and correction by Bacon himself'; see "Works", III, 3-7.

17 For the dating of the *De fluxu* see G. Rees, 'Francis Bacon on verticity and the bowels of the earth', Ambix, 1979, xxvi, 202-11 (209, note 7). The *De fluxu* was written in association with the *Descriptio globi intellectualis* (1612), and *Thema coeli* (1612). The *De fluxu* is actually mentioned in the *Thema*; see "Works", III, 4, 776.

18 See ch. 5, sect. b.

19 See ch. 1, sect. b.

20 For instance, Part A has nothing to say about vital spirit but Bacon refers to it in Part B. Moreover Part B shows Bacon working with more fully developed theories and with a more highly integrated theoretical framework than he was when Part A was drafted. This suggests that new elements had entered into Bacon's thinking in the interval between the completion of Part A and the drafting of Part B; see ch. 4.

21 See ch. 4.

22 The *Historia vitae* is, of course, a much fuller treatment of questions relating to the prolongation of life than the *De viis mortis*. Much of the theoretical equipment used in the *De viis mortis* reappears, in a more polished form in the *Novum organum*; see ch. 4, sect. c, and ch. 5, sect. b.

23 See "Works", I, 8-10.

24 See Rees, op. cit (1), pp.378-9 (378, note 9).

25 "Works", I, 9: '*Abcedarium Naturae*, or a Metaphysical piece which is lost; ... *Historia Densi et Rari*, not yet printed; *Historia Gravis et Levis*, which is also lost ...' The first of these has come to light recently, see note 1.

26 For instance, Bacon retained the *Descriptio globi intellectualis* (1612). That was an unfinished revision of The advancement of learning (1605), a revision superseded by the *De augmentis scientiarum* (1623). He also held on to rough drafts and notes of work in progress; see Rees, op. cit.(1), 377-80.

27 In both versions of his will, Bacon left 'a casting bottle of gold' to William Cavendish; see Spedding, op. cit. (11), VII, 288, 542.

28 It is highly unlikely that Rawley ever owned the manuscript. Rawley either published his Bacon manuscripts or bequeathed them to his son

from whom they passed to Tenison. If Rawley had owned the *De viis mortis* Tenison would have inherited it. But it seems most improbable that Tenison ever possessed it. Had he done so he would probably have published it; after all, he published Bacon materials of far less importance. If he had owned the manuscript and not published it, it would probably have remained in the Tenison Library. The Library was sold off in 1861 but the auction records contain no reference to any Bacon manuscript that fits the description of the *De viis mortis*. On these matters see Rees, op. cit. (1), 378.

29 All Boswell's Bacon manuscripts seem to have passed to Isaac Gruter who seems to have published all the ones concerned with natural-philosophical topics; see "Works", III, 3-7.

30 The manuscript was probably acquired before the end of the seventeenth century.

31 Thomas Hobbes served briefly as secretary to Bacon. He was introduced to Bacon by William Cavendish, Baron Hardwick (later 2nd Earl of Devonshire): S. I. Mintz, 'Hobbes, Thomas', DSB.

32 "Works", I, 11; see also Rees, op. cit. (1), 379, note 15.

33 For a comparison of the two versions see ch. 4, sects. c-e.

34 This intention is mentioned on fol.3r. For Bacon's crucial distinction between living beings considered in so far as they share properties with inanimate things and living beings considered *qua* animate beings, see ch. 3, sect. a.

35 See fols.19v, 20r.

36 '*Aphorismus* 6', fol.27r.

37 For the doctrines presented in these aphorisms see chs. 3-5. These aphorisms are very like *canones* II and IV of the *Historia vitae*, see "Works", II, 213-14.

38 The cancelled title is on fol.8v.

39 I say 'seems' because part of the title (at the top of fol.22r) has been trimmed off.

40 Fol.27r.

41 See Table 1, col.6; also see fol.8v.

42 Fols.19v, 20r, 20v, 30v.

43 All the cancelled passages endorsed '*descr.*' form a sequence (fols. 21r-27r) which, though interrupted by blank pages, is unbroken by any passage not so endorsed.

44 See Rees, op. cit. (1), 386-93.

45 When Bacon revised The advancement to produce the *De augmentis* he reorganised the text on Ramist principles; i.e., the argument runs, through a hierarchy of dichotomies, from propositions of the highest generality via propositions of less generality to concrete examples. He began the task of imposing a Ramist framework on the text when he wrote the *Descriptio globi*, the unfinished revision of The advancement.

2 The *De viis mortis* and the speculative philosophy

(a) Bacon's two philosophies

It is still not generally appreciated that Bacon fathered not one but two philosophies. The one with which the *De viis mortis* associated has only just begun to make its presence felt, while the other has virtually monopolised the attentions of Bacon's commentators from the seventeenth century down to our own time.

The more conspicuous of the two comprises the method and programme for the reconstruction of the natural sciences. The programme, a potent and original synthesis of ideas drawn from disparate sources, was aimed at nothing less than the restitution of 'human sovereignty and power' over nature (1). At the heart of the programme lay the inductive method - a set of logical routines supposedly capable of wresting new sciences from natural history. Indeed Bacon redefined traditional natural history in functional terms. He visualised it as a colossal series of collections of scrupulously verified empirical, experimental and technological data, data from which the inductive method would generate knowledge capable of yielding new technologies to ameliorate progressively the material conditions of mankind (2). In essence, this utilitarian programme presupposed (for such was its scale), the institutionalisation of science, state financing, and cooperative research. In these and other respects it represented a revolution in attitudes, a revolution which had a profound effect upon the character of English thought in the seventeenth century and beyond (3).

Nevertheless, the *De viis mortis* resists interpretation in terms of this philosophy and, therefore, of the traditional concerns of Bacon scholarship. The *De viis mortis* expresses developing aspects of Bacon's other philosophy - the *speculative* philosophy. This philosophy, which evoked virtually no response from Bacon's seventeenth-century successors (4), is not a logic of scientific discovery or a set of programmatic recommendations. It is, instead, a systematic body of wide-ranging theories about the structure of the universe, the nature of matter and, in principle, all the phenomena of nature, organic and inorganic. It permeates Bacon's writings: elements of the system can be traced in the earliest documents of his philosophical career. In fact, the system began to take shape in the early 1590s, and it grew and developed right up to the time of Bacon's death in 1626 (5). It manifests itself almost

everywhere - not least in works intended as contributions to the massive, unfinished six-part *Instauratio magna*. When turning the pages of the *Novum organum* (1620), *Historia vitae et mortis* (1623), and *Sylva sylvarum* (1626), one can hardly fail to be struck by the sheer range of phenomena which Bacon tried to sweep into the speculative net. From 1620 he seems to have made concerted efforts to justify the speculative philosophy by exhibiting its capacity for making sense of an increasingly comprehensive array of processes and events in the natural world.

It is also apparent that he actually designed the *Instauratio*, the crowning achievement of his philosophical career, as a vehicle not just for the method and programme but for the speculative system as well. Speculative materials incorporated in Parts One to Four of the *Instauratio* were meant to prepare the way for a full, articulated account of the system in Part Five (6). Unfortunately Bacon did not live to write Part Five. Had he lived longer the job of reclaiming and reconstructing might have been a lot easier. All the same, the projected Part Five account was to have served as an interim or provisional natural philosophy to be enjoyed or embraced pending the implementation of the method and programme which would produce the only 'legitimate' new philosophy. The fruits of the method were to have been revealed in Part Six. Parts Five and Six may therefore be seen as the termini of two semi-independent lines of thought within the *Instauratio* - the speculative and natural-historical-inductive respectively (7). The two lines should not be regarded as wholly independent - not least because Bacon evidently nurtured the hope that, in the fullness of time, the speculative philosophy would turn out to be accurate enough for materials in Part Five to be promoted into Part Six (8).

As has been said, the influence of the speculative philosophy is not confined to the *Instauratio* and its component texts. In fact, it is difficult to find any philosophical work of Bacon's that was not touched in some way by his speculative preoccupations. In works written before 1620, as in the works of the *Instauratio*, he elaborated aspects of the system, tried to apply them to new phenomena, amassed experimental and observational data, and challenged theories inconsistent with his own. Nowhere is that more apparent than in the *Thema coeli*, *Descriptio globi intellectualis*, *De fluxu et refluxu maris* and the *Phaenomena universi* - the cluster of works composed during or not long before the time when the Hardwick amanuensis was busy copying up Part A of the *De viis mortis*. However, even in works which appear to bear few traces of the speculative philosophy, Bacon's speculative preoccupations often hold the key to obscure or disputed passages. That is true, for example, in the case of his reflections on classical atomism (9).

In short, Bacon invested a huge amount of labour and intellectual capital over a long period of time in this little-known philosophy and,

in this connexion, the recovery of the Hardwick manuscript is timely. The manuscript deals with aspects of that philosophy rather than with methodological issues. It is the longest Bacon manuscript to have been discovered since the seventeenth century. Both these facts strengthen the case for believing that the question of the relationships and balance between the speculative and methodological enterprises will become a central issue in Bacon studies (10). In any event it is becoming increasingly apparent that studying Bacon without the speculative philosophy is about as old-fashioned as studying Newton without the alchemical and theological writings.

(b) The speculative philosophy: an outline

The speculative philosophy embraces but goes far beyond the immediate concerns of the Hardwick manuscript. However, the coherence and integrity of this philosophy is such that a clear understanding of its principal features, even of ones seemingly remote from the doctrines of the *De viis mortis*, is necessary in order to render the manuscript fully intelligible. Furthermore without such an understanding it would not be easy to see that the manuscript marks an important stage in the consolidation of the speculative philosophy (11). What follows, therefore, is a summary account of the system's main ramifications.

The speculative system represents a calculated response to the post-Copernican ferment in astronomy and cosmology, the anti-Aristotelian system building of Telesio , Doni, and Gilbert, aspects of Arabo-Latin medical tradition and, above all perhaps, to the philosophy of Paracelsus who had tried to establish chemistry as the royal road to a new understanding of the natural world. Moreover, in its combining of elements derived from disparate traditions the speculative philosophy is, like Bacon's method and programme, eclectic to a degree. Paracelsian chemistry, late Renaissance pneumatism, natural magic, and even Islamic ideas on celestial motion contributed to a system which, within the confines of a rather conservative conception of the universe, achieved a certain bizarre individuality.

Bacon's universe is a finite geocentric plenum. Its outer limit is marked by the region of the fixed stars beyond which the physical universe gives way to the 'perfect empyrean' or 'immaterial heavens'. For knowledge of the empyrean we must rely 'entirely on religion'. As for the interface between the empyrean and the region of the fixed stars, we can know nothing of it because we can obtain no empirical evidence of its nature (12). The stars themselves move from east to west about the centre of the universe. At the centre sits the static earth (13). The earth consists almost entirely of dense, passive, sluggish *tangible* matter. The rest of the physical universe is filled with

weightless, invisible, vaporous and active *pneumatic* matter. The distinction between tangible and pneumatic is the pivot on which the entire speculative philosophy turns. The distinction is 'quite primordial and the one which is most employed in the system of the universe' (14).

Like Bernardino Telesio (1509-1588) and William Gilbert (1544-1603), Bacon believed that the earth had a pure, incorruptible interior enveloped in a mutable crust (15). But Bacon did not follow his predecessors who visualised the interior as a source of activity. On the contrary, he saw it as the abode of complete passivity, of homogeneous, utterly immobile and exceedingly dense tangible matter. Above and surrounding this stable core was the earth's crust which formed part of the frontier zone between the pure, tangible interior and the pure, pneumatic celestial regions. In this frontier zone tangible and pneumatic matter are forced to meet and mingle. The heat of the sun and other heavenly bodies relaxes tangible matter and impregnates it with active pneumatic matter. The forced association of these contrary states of matter is the source of most terrestrial mutability, and the working of pneumatic on tangible matter is the source of all organic and inorganic growth and decay in the terrestrial region (16).

Bacon made most of these points, separately or together, in a number of works. The concept of the universe as an entity comprising two different regions of stability sandwiching a region of mutability first appeared in a piece written in the early 1590s (17). Indeed, this notion seems to have been coextensive with his philosophical career - which is more than can be said for any specific methodological doctrine. The same notion, together with other elements mentioned above, occurs in its most compact formulation in the *Historia vitae*, and that formulation (18) was clearly based on the two drafts of '*Aphorismus* 1' which Bacon drew up in Part B of the *De viis mortis*. The presence of the two drafts (fols.22r, 25r) suggests that one of Bacon's aims while revising and adding to the amanuensis' copy was to secure or expose more fully the theoretical foundations which supported his proposals for prolonging life (19).

Now the zone of mutability surrounding the earth's core extends no further into the depths than the rays of the heavenly bodies can penetrate - a few miles at most. It reaches no further above the earth's surface than 'the lower parts of the heavens (which we call the middle region of the air)'. Only in this zone is pneumatic matter to be found trapped in tangible bodies. The trapped pneumatic matter is called 'attached' spirit to distinguish it from the 'free' spirits which exist outside tangible matter (20). There are four kinds of free spirit, and these fill the entire universe above the surface of the earth. Two of them, air and terrestrial fire, belong to what an Aristotelian would have called the sublunar region of the universe - though Bacon acknowledged no absolute break between the sub- and superlunar realms (21). The other two, ether and sidereal fire, belong to the celestial realm. Ether is the

medium in which the planets, globular aggregations of sidereal fire, move around the central earth (22).

The interplanetary ether is, in effect, a very tenuous and pure kind of air; and both air and ether belong to a 'family' of qualitatively related substances which also includes watery, non-inflammable bodies and mercury. This family is the *mercury quaternion*. Terrestrial fire, on the other hand, may be regarded as a feeble, corrupt version of sidereal fire; and the two forms of fire join with oil, oily or inflammable bodies and sulphur in membership of the *sulphur quaternion* (see Table 2). These two hostile, qualitatively

	SULPHUR QUATERNION	MERCURY QUATERNION
TANGIBLE BODIES (WITH 'ATTACHED' SPIRITS)	Sulphur (subterranean)	Mercury (subterranean)
	Oil and oily, inflammable substances (terrestrial)	Water and 'crude' non-inflammable substances (terrestrial)
'FREE' SPIRITS	Terrestrial fire (sublunar)	Air (sublunar)
	Sidereal fire (planetary matter)	Ether (planetary medium)

Table 2. The two quaternions

antithetical quaternions (alluded to in Part B of the *De viis* (fol.17r)) dominate Bacon's conception of the universe (23). The free pneumatic members of both quaternions become increasingly pure with distance from the earth. But air and ether (mercury quaternion) are locked in a cosmic conflict, in an unremitting vendetta against terrestrial and sidereal fire (sulphur quaternion). Giving full rein to his passion for antitheses, Bacon tended to see air and ether as allied armies struggling to contain terrestrial and sidereal fire, the enemies in their midst (24).

At any point in the universe the issue of the struggle depends on distance from the earth. Air beneath the moon and ether above it become progressively weaker with distance from the terrestrial globe; conversely, terrestrial and sidereal fire become stronger. On earth, terrestrial fire is surrounded by hostile, overpowering air and cannot survive without fuel. It aspires to take on the globular, self-sustaining, mobile nature typical of the sidereal fire of the planets. But it cannot succeed except for brief intervals in highly artificial, experimental circumstances (25). Away from the surface of the earth, where the air is weaker, terrestrial fire begins to acquire 'a certain duration ... as happens for a time in some of the lower comets' (26). Fire does not become strong enough to attain permanence until we reach the sidereal fire of the moon. But even the moon, the 'first rudiment

and last sediment' of sidereal fire, is relatively weak in relation to the surrounding ether (27). By contrast, the sidereal fire of the most remote planet, saturn, is stronger and purer than that of any planet beneath it. But even in saturn the sidereal fire is not as powerful as it is in the fixed stars. In the heaven of the fixed stars the conflict of fire and ether is resolved. Here fire actually compels the enervated ether to combine with it; here the ether is 'so converted, wrought, and assimilated as to become completely patient and obedient' to the highest member of the sulphur quaternion (28).

This conception of the universe owes much to the 'chemical' philosophy of Paracelsus (1493-1541), and his followers. Recent research has shown that basic features of Bacon's system such as the association of water and air with mercury, fire with sulphur, and the perpetuation of those associations in a purer form in the heavens appear to have been derived from 'Mosaic' cosmogonies of the kind elaborated by Gerard Dorn, Oswald Croll, Robert Fludd, and the French iatrochemist Joseph Duchesne (29). But although Bacon drew on Paracelsian tradition, he was not of it. He did not follow the Paracelsians slavishly; he reshaped and streamlined Paracelsian cosmogony and matter theory to suit himself. In fact, the bi-quaternion theory may be seen as an attempt to rationalise Paracelsian confusions regarding the relationships between the three principles (sulphur, mercury, and salt) and the four element-matrices (earth, water, air, and fire). Bacon regarded sulphur and mercury as nothing other than natural substances. They had the same ontological status as other members of the two quaternions. As for the Paracelsian principle salt, that was a fiction. It was in reality nothing more than a compound of natural sulphur and mercury, and it had no cosmo-logical significance whatever (30) even though it did have a special place in Bacon's matter theory (31).

Bacon's revision of Paracelsian ideas was also an exercise in 'demystification'. His cosmology had no place for intricate Paracelsian elaborations of the microcosm-macrocosm analogy, for the gnostic, astrological and numerological predilections of Fludd, or for the habit of 'reading' the universe as the result of a process of alchemical separation - a process enigmatically figured forth in the Biblical creation story (32). But Bacon's most striking departure from Paracelsian thought lay in the fact that he endowed his world system with a geometrical description of celestial motion. He reshaped Paracelsian cosmic chemistry on the anvil of celestial geometry. Any 'strict' Paracelsian would have abhorred that feat. In the early seventeenth century, Paracelsians viewed the aspirations and pre-occupations of astronomers with indifference or hostility - feelings cordially reciprocated by the astronomers (33). Bacon, on the contrary, bridged the gap between the chemists and astronomers. He smuggled a version of Paracelsian chemistry into the domain of astronomy, reform-ulated Paracelsian ideas, and brought them to bear on what he regarded as the most pressing problems facing the astronomers of his day (34).

Bacon's sensitivity to the implications of post-Copernican astronomy, his anti-fictionalism, and desire for an alternative to Ptolemaic celestial geometry led him to adopt the kinematic principles of the Spanish Aristotelian Nūr al-Dīn al-Biṭrūjī who was known in the Latin West as Alpetragius (fl.1185-1217). The Alpetragian system enjoyed some favour in the Middle Ages and some currency in the sixteenth century - perhaps in the wake of the upsurge of homocentric purism associated with Fracastoro and Amici (35). It also seems to have been part of the small change of astronomical discourse as late as the seventeenth century - though Bacon was the last major figure to have taken it seriously (36).

Since Alpetragius has little to do with the *De vijs mortis*, suffice it to say that he proposed that the compounded circles of the Ptolemaic astronomers should be jettisoned in favour of 'spiral lines', and that planetary periodic motion (traditionally thought to run counter to the westward diurnal motion) should be regarded as an abatement of diurnal motion - such that the lower a planet the more it lags behind a higher. Thus the stars complete their vast circuit, from east to west, in twenty-four hours whereas the moon, lowest of the planets, takes twenty-five hours to complete its much shorter course (37). The congruity of these doctrines with Bacon's cosmic chemistry is obvious. In Bacon's system the heavens move from east to west - driven by an obscure sympathetic force. But the lower the planet the slower and more erratic its motion becomes; and that is a consequence of the fact that the sidereal fire of which the planets are composed becomes more degenerate and susceptible to the interference of ether the closer it is to the centre of the universe (38).

The diurnal motion, progressively attenuated with proximity to the earth, is not confined to the heavens alone. Bacon's chemistry enabled him to defy Aristotle by projecting the diurnal motion into the sublunar realm. Ether, the celestial member of the mercury quaternion, participates in the diurnal motion and transmits that motion to other members of its quaternion - in particular to air and water. Since air is affected by the cosmic motion there must be a constant wind blowing from east to west over the face of the earth - an idea which Bacon elaborated in the *Historia ventorum* (1622). The influence of the cosmic motion on water produces the sexhorary cycle of the tides - an aspect of the system which Bacon developed in the *De fluxu et refluxu maris* and the *Novum organum* (39).

So compelling was the idea that the cosmic motion might be used to explain sublunar phenomena that Bacon even toyed with the idea of interpreting crustal verticity (the magnetic orientation of bodies to north and south) as a latent manifestation of the cosmic motion. The idea was quickly abandoned but Bacon's reasons for entertaining it are important. It attracted him because he wanted to emulate William Gilbert's work on this topic (40). It may also have attracted him because of his metaphysical taste for intermediates, his tendency to

suppose that where there were two antithetical states or substances there would also be a state or substance embodying aspects of both terms of the antithesis. Thus, if one were looking for an intermediate state between the constant motion of the heavens, wind, and tide and the total immobility of the earth's interior, then crustal verticity would seem to be an obvious candidate. After all, 'direction and verticity towards the poles in rigid bodies is the same thing as revolving upon poles in fluid' (41).

It is not surprising that Bacon's taste for intermediates may have led him to the abortive verticity theory. The predilection had absolutely crucial consequences for his speculative philosophy. In that philosophy and in the *De viis mortis*, intermediates played a leading role. In its developed form the speculative philosophy had two interlocking departments. The first comprised 'cosmological' phenomena - the structure and substance of the universe, and manifestations of the diurnal motion in the heavens, wind, tide and (temporarily) crustal verticity. The second dealt with the manifold changes in the animal, vegetable, and inanimate kingdoms of the terrestrial world. The second department was logically dependent on the first, for the set of explanations which Bacon applied to the terrestrial domain was systematically integrated with but subordinated to explanations deployed in the 'cosmological' domain. The latter was dominated by the theory of the two quaternions, the former by explanations framed in terms of intermediates; that is, substances which combined qualities of one member of one quaternion with qualities in the corresponding member of the other quaternion (42).

Just as there are four categories in each quaternion so there are four types of intermediate (see Table 3). The highest of the four is

	SULPHUR QUATERNION	INTERMEDIATES	MERCURY QUATERNION
TANGIBLE BODIES (WITH 'ATTACHED' SPIRITS)	Sulphur (subterranean)	Salts (subterranean, and in organic beings)	Mercury (subterranean)
	Oil, and oily inflammable substances (terrestrial)	Juices of animals and plants	Water and 'crude', non-inflammable substances (terrestrial)
'FREE' SPIRITS	Terrestrial fire (sublunar)	'Attached' animate and inanimate spirits (in tangible bodies)	Air (sublunar)
	Sidereal fire (planetary matter)	Heaven of the fixed fixed stars	Ether (planetary medium)

Table 3. The quaternions and their intermediates

the compound of sidereal fire and ether. As has been seen this compound (in which sidereal fire is the senior partner) constitutes the heaven of the fixed stars. This intermediate does not of course play any direct part in the ceaseless changes of the terrestrial realm and in that respect it is quite different from the other three intermediates. The lowest of these three is the sulphur-mercury intermediate, salt. As has been said, Bacon rejected Paracelsian ideas about salt. For him salt was not a principle nor did it have any cosmological significance (43). He regarded salt as a compound of sulphur and mercury: 'For all salt has some inflammable parts; and some parts which not only do not conceive flame, but strenuously shrink from and avoid it' (44). Salt has no role in the chemistry of the cosmos but it has some importance in the chemistry of living things. According to the *De viis mortis* (fol.17v), and the preface to the projected *Historia sulphuris, mercurii, et salis* salt is nothing less than 'the rudiment of life', and an inorganic analogue of the next class of intermediates - the class poised between oil and water (45).

The oil-water intermediates are the juices (sap, blood etc) of plants and animals. These intermediates make frequent appearances in the pages of the *Novum organum*, *Historia vitae et mortis*, *Historia densi et rari*, and the *Sylva sylvarum*. According to these texts, 'all plants consist of an oily and watery substance commixed'; they partly feed on the sulphur-mercury intermediate salt (especially nitrous salt); and their oily and watery components are much more 'subtly and finely mingled' than would be the case had they been mixed by mere human agency (46). The oil-water juices of animals also have some salinity in their constitution. There is, for instance, a 'secret' saltness in blood and sweat; indeed, blood has 'some sympathy with salt, for all life hath a sympathy with salt. We see that salt laid to a cut finger healeth it; so as it seemeth salt draweth blood, as well as blood draweth salt' (47). In animals, as in plants, the relative oiliness or wateriness of the juices is a factor which differentiates one species from another. Moreover, the oil-water theory of animal juices is, when applied to human beings, important for Bacon's proposals for attaining the goal of the *De viis mortis* - namely, the prolongation of life (48).

In the bi-quaternion theory oil and water correspond, respectively, to flame and air. The flame-air intermediates are the most important for an understanding of the theoretical basis of the *De viis*. These intermediates are the 'attached' spirits mentioned earlier, the ones lodged in the tangible matter of the realm of mutability. There are two sorts of attached spirit: the inanimate, and animate or vital. The inanimate are incarcerated in all tangible bodies including living ones; the vital spirits are found only in living bodies. Both kinds coexist, therefore, in organic beings. Both kinds also come in many different varieties but, whereas all inanimate spirits are air-fire compounds with the airy component dominant, the vital spirits have more fire than air in their constitution; consequently they have 'a degree of inflammation [*nonnullam incensionem*], and ... this inflammation supplies

peculiar motions and faculties' characteristic of living things (49).

Vital spirit, unlike inanimate spirit, is always reluctant to leave the bodies enclosing it since there is nothing in the terrestrial environment similar to it (50). The inanimate spirits, on the other hand, are always itching to escape from their tangible jails. The dominant airy component of inanimate spirit endows it with an 'appetite' for uniting with the external air. Air and spirit conspire to effect the latter's release from tangible matter. However, if the spirit is not strong enough to escape, it attacks susceptible parts of its tangible prison and converts them into more spirit. Once enough spirit has been created and the tangible body sufficiently weakened in the process, the spirit escapes into the air. The innate tendency of this restless spirit to attack tangible substances, to convert them into more spirit, and to escape into the air lies at the very root of many of the most important effects discernible in the organic realms - as the *De viis mortis* seeks to demonstrate (51).

Bacon's matter theory thus comprises twelve major categories (52) - the eight substances of the two quaternions, and the four intermediates. These interrelated categories constitute the foundation of the speculative philosophy. This chemical theory of matter is the key to the system of the universe; it is the framework which unites all branches of natural philosophy. It is the explanatory framework with which Bacon sought to interpret all natural phenomena - from plant to planet, from spirit to star. The subject matter of the *De viis mortis* belongs, therefore, within the matrix of a 'total' approach to the natural world. It marks, moreover, a stage or stages in the emergence of an explanatory framework which goes far beyond the immediate, terrestrial phenomena with which the text is mainly concerned. As we shall see, the *De viis mortis* appears, at points, to show the speculative philosophy in a crucial phase of its development, the phase during which its connective tissues began to knit together.

Notes to Chapter 2

1 Bacon, "Works", III, 218; also see I, 132, 653, III, 295. There are many studies of aspects of the method and programme. The following modern studies are useful: P. Rossi, '*Francesco Bacone: dalla magia alla scienza*', revised edn., Torino, 1974; L. Jardine, "Francis Bacon: discovery and the art of discourse", Cambridge, 1974; M. Horton, 'In defence of Francis Bacon: a criticism of the critics of the inductive method', Stud. Hist. Phil. Sci., 1973, iv, 241-78; M. Hesse, 'Francis Bacon's philosophy of science', in B. Vickers (ed.), op. cit. (ch. 1, 2), pp.114-39.

2 Bacon, "Works", I, 136-42, 395-411, II, 13-16.

3 For Bacon's influence on seventeenth-century thought: R. F. Jones, "Ancients and moderns", Washington, 1961, pp.41-61; C. Webster, "The great instauration: science, medicine and reform 1626-1660", London, 1975; M. Hunter, "Science and society in Restoration England", Cambridge, 1981, chs.1, 2, 4.
4 See G. Rees, 'The fate of Bacon's cosmology in the seventeenth century', Ambix, 1977, xxiv, 27-38.
5 Some of the fundamental doctrines of the speculative philosophy first appeared in a piece entitled "Mr. Bacon in praise of knowledge", see Spedding, op. cit. (ch. 1, 11), I, 123-6. This piece is part of a longer entertainment, see J. Spedding, "A conference of pleasure, composed for some festive occasion about the year 1592 by Francis Bacon", London, 1870. Also see ch.4, sect.a.
6 For the plan of the *Instauratio magna* see Bacon, "Works", I, 135-45. For an indication of the ways in which Bacon used the *Instauratio* as a vehicle for the speculative philosophy see G. Rees, 'Francis Bacon's semi-Paracelsian cosmology and the "Great Instauration"', Ambix, 1975, xxii, 161-73.
7 Bacon's intentions for Part Five were outlined in the *Distributio operis* (1620), see "Works", I, 143-4. Also see Rees, op. cit. (6), pp.171-3.
8 "Works", III, 547. Also see ch.5, sect.c.
9 See G. Rees, 'Atomism and "subtlety" in Francis Bacon's philosophy', Ann. Sci., 1980, xxxvii, 549-71.
10 See G. Rees, 'Francis Bacon's biological ideas: a new manuscript source', in B. Vickers (ed.), "Occult and scientific mentalities in the Renaissance", Cambridge, forthcoming. Also see ch.5, sect.c.
11 The place of the *De viis* in the development of the speculative philosophy is examined in the chapters below.
12 "Works", III, 745, 747, 772.
13 Ibid., 769, 771; also see G. Rees, 'Francis Bacon's semi-Paracelsian cosmology', Ambix, 1975, xxii, 81-101 (86).
14 "Works", III, 769; Rees, op. cit. (13), 85-6.
15 "Works", III, 95, 98, 779; Rees, op. cit. (ch. 1, 17), pp.203-5.
16 "Works", I, 228, III, 32-5, 95-6, 626.
17 See above, note 5.
18 "Works", II, 213.
19 This aspect of the *De viis* is considered in following chapters.
20 "Works", II, 254; also see G. Rees, 'Matter theory: a unifying factor in Bacon's natural philosophy?', Ambix, 1977, xxiv, 110-25 (110-11).
21 "Works", I, 329, III, 33, 88, 769; also see Rees, op. cit. (13), pp.86-7.
22 "Works", II, 82-3, III, 771.
23 See Rees, op. cit. (13), pp.85-8, 94, 98-101.
24 "Works", III, 771.
25 Ibid., I, 303-4, II, 352-3, III, 770.
26 Ibid., III, 770.
27 Ibid., III, 770-1.
28 Loc. cit. For an examination of Bacon's view of the nature of the

heaven of the fixed stars see Rees, op. cit. (20), pp.117-18.
29 Rees, op. cit. (13), pp.81-5, 88-91.
30 "Works", I, 359, II, 82-3, 459, 543, III, 770.
31 See this chapter below.
32 Rees, op. cit. (13), pp.90-1.
33 See A. G. Debus, 'Motion in the chemical texts of the Renaissance', Isis, lxiv, 1973, 5-17.
34 Rees, op. cit. (13), pp.94-6.
35 On Alpetragian astronomy see B. R. Goldstein (ed.), "Al-Biṭrūjī; on the principles of astronomy; an edition of the Arabic and Hebrew versions with translation, analysis, and an Arabic-Hebrew-English glossary", 2 vols., New Haven, 1971. For medieval responses to Alpetragian astronomy see P. Duhem, "*Le système du monde*", 10 vols., 2nd edn., Paris, 1954, I, 242-3, 282-7, 328-9. For the work of Amici and Fracastoro see W. H. Donahue, 'The solid planetary spheres in post-Copernican natural philosophy', in R. S. Westman (ed.), "The Copernican achievement", Los Angeles, 1975, pp.244-75 (246). Alpetragius' work was known, in the sixteenth century, to Regiomontanus, Copernicus, Thomas Digges and John Dee; see F. J. Carmody, 'Regiomontanus' notes on al-Biṭrūjī's astronomy', Isis, 1951, xlii, 121-30; E. Rosen, 'Copernicus and al-Biṭrūjī', Centaurus, vii, 1961, 152-6; F. R. Johnson, "Astronomical thought in Renaissance England", Baltimore, 1937, p.98. Dee owned a copy of Alpetragius' work in manuscript; see J. O. Halliwell (ed.), "The private diary of Dr. John Dee, and the catalogue of his library of manuscripts", London, 1842, p.69.
36 Other major figures did not take Alpetragian astronomy very seriously. For instance, Kepler's opinion of Alpetragius seems to have been rather low; see A. Neher, 'Copernicus in the Hebraic literature from the sixteenth to the eighteenth century', J. Hist. Ideas, 1977, xxxviii, 211-42 (217).
37 Rees, op. cit. (13), p.93.
38 "Works", III, 773-5.
39 Ibid., I, 291-2, 327, II, 26-7, III, 47-8, 56, 59-60; also see Rees, op. cit. (13), pp.98-100.
40 For Bacon's theory of verticity see Rees, op. cit. (ch. 1, 17), passim.
41 "Works", III, 58.
42 This aspect of the speculative philosophy and the theory of intermediates is reconstructed in Rees, op. cit. (20).
43 Rees, op. cit. (13), p.88.
44 "Works", II, 82-3.
45 Ibid., II, 543.
46 Ibid., I, 318, II, 214, 303, 476, 485, 520-1, 536.
47 Ibid., II, 539-40.
48 Ibid., II, 219-26.
49 Ibid., I, 340, II, 119-20, 214-16, 451-2, 528-31, 556-7, 613-14, 616.
50 Ibid., II, 216.
51 Fols.2v-5r; also see "Works", II, 106, 451-2, 556-7.
52 I have excluded the minor category of 'imperfect' spirits since these

appear to be nothing but relatively unimportant 'by-products' of major components of the twelve-category matter theory. For 'imperfect' spirits see "Works", II, 254; Rees, op. cit. (20), p.123, note 7.

3 The spirit of life

(a) Spirits vital and inanimate

The distinction between vital and inanimate spirit lies at the heart of the *De viis mortis*, and for that matter, Bacon's approach to all biological problems. Dissociating himself from alternative theories of ageing and death (1), he staked his claim to originality on a single, fundamental assertion. In the *De viis* (fols.3r, 21r, 28r, 29r), and elsewhere (2) he insisted that living beings should be regarded not simply as possessing attributes peculiar to living things but as sharing properties typical of all inorganic beings. Although living beings were distinctive in that they possessed vital spirits, they had to be viewed as if they were inorganic things to the extent that their tangible parts were suffused with inanimate spirits.

The vital spirits restrain and control the impulses of the inanimate but eventually the latter must prevail and destroy the living body in very much the same way as they alter or destroy non-living bodies (fol.3r). Life is a condition of uneasy equilibrium in which the vital spirit can resist the destructive centrifugal tendencies of the inanimate spirit lodged within the tissues of the body. In the long run, the inanimate spirit will always get the upper hand and spoil the organs necessary for the maintenance of the vital (3). As the *De viis* points out, in words later echoed in the *Historia vitae et mortis* (4), living beings age and die because they suffer like the victims of Mezentius - the easily reparable parts (vital spirit, blood, humours etc.) die in the embrace of the less reparable (nerves, membranes and bones), parts which have been undermined by the activities of the inanimate spirits (fols.28r, 29r). In fact, the fate of living things is, in some ways, less pleasant than that of stones, metals, and so forth. Stones and metals cannot starve to death. But possession of a vital spirit entails constant consumption of the body and, therefore, the need to take nourishment; and nourishment itself can stimulate the destructive proclivities of the inanimate spirit - which is one of the reasons why some inorganic bodies are far more durable than many living ones for, left to themselves, their inanimate spirits do their work far more gradually (5).

In short, Bacon believed that other writers on ageing, death, and the prolongation of life had made a grave mistake in devoting their

attentions exclusively to the distinctive qualities of living things (fol.29r). He also believed that that mistake had been compounded by the anatomists' failure to investigate the nature of the spirits (6). He viewed living bodies as if they were non-living, as complex arrangements of tangible matter housing the shock troops of the speculative philosophy, the aggressive inanimate spirits. At the same time, he also regarded these arrangements of tangible matter as cradles of vital spirit, the essence of life. Without such a dual view, without considering living beings simultaneously as living *and* as if they were inorganic, efforts to understand ageing and mortality would be doomed to frustration.

Now the vital spirit, by virtue of its chemistry and 'inflammation', makes living creatures what they are - entities which grow, feed, reproduce and die. But, in accordance with the view that the inanimate spirits were the principal factors in ageing and death, Bacon wrote relatively little about vital spirit. In this connexion, it is useful to distinguish between the works of 1620 to 1626 (which were written for the *Instauratio*) and works of earlier date (which were not).

The theory of vital spirits belongs almost entirely to the works of the *Instauratio*, and even there it appears far less frequently than the theory of inanimate spirits (7). However, the theory of inanimate spirits appears from time to time from the early 1590s onwards (8). But inspection of the published documents of the period before 1620 reveals no distinctive reference to the vital spirit. Of course, there are intermittent, colloquial, and non-technical references to 'the spirit of man', 'bold and unquiet spirits', and the like (9). There is also a statement in the *Cogitationes de natura rerum* (c1604) that certain processes in animals 'are performed with a sensation of pain, according to the different kind and character of the violence, the spirit pervading everything ... a just distinction of the passions of matter will give the number of senses, provided only that the requisite organs be supplied, and the spirit added' (10). But even this isolated reference says nothing about the chemistry of the spirit, whether it is material or not, whether it is different from the soul or distinguishable from inanimate spirit. The principal elements of the doctrine of vital spirit appear to be latecomers to Bacon's philosophy. As far as the published works are concerned, the conception of vital spirit would appear to have originated in the last years of Bacon's life.

This last impression has been invalidated by the discovery of the *De viis mortis*. The Hardwick manuscript is typical of Bacon's work as a whole in that it says much more about inanimate spirit than the vital. More significantly the text drafted by the amanuensis does not mention vital spirit at all. In passages where one expects to find references to vital spirit, one only finds passing allusions to a 'vital nature' (fols.3r, 8v). But discussion of vital spirit does most emphatically occur in Part B (fols.16r, 17v, 21r, 26v, 27v, 28r, 28v). In that respect

Part A is closer to works written before 1620, and Part B closer to the works of the *Instauratio*. At all events it is now clear that the concept of vital spirit came into existence before Bacon wrote the works of the *Instauratio*, and that the *De viis mortis* provides us with the only surviving record of his thinking on that topic before 1620. It is also fairly likely that he first set his mind to the business of piecing together the theory of vital spirits in the interval between the completion of Part A and the writing of Part B.

(b) The great trichotomy

Amid the welter of revisions and expansions imposed on the original Part A text, one grand fact stands out: that Bacon was trying to weld elements of the emerging speculative system into a single, coherent structure. He was trying to adjust existing features of the system to new ones, or bring already existing but previously separate ones into a systematic relationship with each other (11). In fact one might say that in many respects the *De viis* marks the point at which his speculative doctrines actually became a system.

In connexion with the vital spirit, Bacon's revisions and expansions of the amanuensis' draft contain the first extant expressions of a fundamental component of speculative philosophy as applied to biological phenomena. It seems that every terrestrial being can be assigned to one of three categories according to the nature of the spirits it possesses. The fact that Bacon injected two formulations of this idea into the revision of the amanuensis' copy is a measure of its importance. Inanimate objects possess only inanimate spirits dispersed in discontinuous portions through the tangible mass; vegetables have such spirits too, but they also have vital spirits organised in a network of branching channels; animals also have inanimate and branching spirits, but they differ from plants in that their branching vital spirits are connected to a cell (*cella*) which is the 'parliament' or 'university' of these spirits (fols.16r, 26v).

This trichotomy (spirits dispersed, branching, and branching with a cell) is given full expression in Bacon's later works - in, for instance, the *Historia vitae et mortis*:

> The lifeless spirits are not continued in themselves (*minime sibi continuentur*), but are as it were cut off (*abscissi*) and surrounded by the grosser body which intercepts them; as air is mixed up in snow or froth. But all vital spirit is continued in itself, by certain channels (*canales*) through which it passes, without being totally intercepted. And this spirit likewise is of two kinds; the one merely branched (*ramosus*), and permeating through small thread-like channels (*permeans per parvos ductus et tanquam lineas*);

> the other having a cell (*cellam*) likewise, so that it is not only continued in itself, but also collected in a considerable quantity, according to the proportion of the body, in some hollow space; and in this cell is the fountain of the streamlets (*fons rivulorum*) which diverge from thence. This cell is chiefly in the ventricles of the brain (*ea cella praecipue est in ventriculis cerebri*) (12).

Here, as in the *De viis mortis*, the trichotomy corresponds in effect to the three sections of the terrestrial chain of being - the inorganic, vegetable and animal. In relation to the chain of being, the *De viis* lacks virtually all the detail present in the works of the *Instauratio*, so it is useful to turn for a moment to these works to put some flesh on the bare trichotomy.

According to the works of Bacon's last years the highest inorganic beings are metals and gems because, like plants, they are generated from subterranean juices. However, these minerals remain obdurately inorganic for they only possess discontinuous portions of inanimate spirit (13). There is no absolute boundary between minerals and plants. Indeed, there exist equivocal entities like coral and vitriol which 'participate of the nature of plants and metals both' (14). Plants, as has been seen, possess not just inanimate spirit but vital spirit organised in a network of channels. Plants are either 'perfect' or 'imperfect'. Imperfect plants, mosses, mushrooms, and other unappealing 'excrescenses', are generated from putrefaction without benefit of seed. These 'nourish, and have a period of life, and have likewise some figure', but they lack 'succession or propagation' (15). Perfect plants stand higher in the chain of being because they spring from seed and so constitute a series of more-or-less fixed morphological types (16).

An organism with vital spirit merely distributed in branching channels can only be a plant. To gain admission to the animal kingdom, an organism must be blessed with vital spirit not just in the branching channels of the 'nerves' and 'sinews', but collected in a cellular concentration located in the brain (17). Moreover, just as the vital spirit is more fiery than the inanimate, so the vital spirit of animals is more 'inflamed' than that of plants. Indeed, the higher the animal the more inflamed is its spirit and the greater the spirit's cell. The lowest animals are the 'imperfect' creatures: worms, fleas, maggots, eels, and so forth. These are bred from putrefaction and their vital spirits 'seem rather to be diffused over the body than seated in cells'; it is not surprising therefore that they continue to writhe after being cut up (18). Lacking large cellular concentrations of spirit they have 'little variety of internal parts' and some morphological instability (19). But some imperfect creatures are less imperfect than others. The bee, for instance, possesses hearing, taste, and sight; it also has enough 'imagination' to find its way back to its hive. That shows that although the spirit of bees is diffused, 'yet there is a seat of their senses in their head' (20).

The lowest perfect animals are the shellfish; they 'have male and female as other fish have' and are not 'bred from putrefaction'. But oysters cling to the very bottom rung of true animal being. 'Participles or confiners' between plants and animals 'they are fixed, and have no local motion of remove.' They will never join the dance and so fall short of the acrobatic horse-mussels which 'not only gape and shut as oysters do, but remove from one place to another' (21). Above the shellfish in the chain of being come the true fish and, above them, flying fish which are located between fish and birds (22). Above the birds comes another transitional form, the bat, a being suspended between bird and quadruped. Between the quadruped and man we find the ape, highest of the purely natural links in the chain (23). Man stands at the intersection of the natural and supernatural stretches of the chain. He partakes of the nature of beasts in that he has a material body but, by virtue of his incorporeal, divinely inspired rational soul, he participates in the supernatural and eternal (24).

As with imperfect animals, so it is with perfect ones: the higher the animal the larger the cell of vital spirit in proportion to the body. Birds, for instance, only have small cells and so, if decapitated, 'quiver for some time'. But 'nobler animals, and men most of all have larger ventricles'. Men not only possess proportionally more vital spirit concentrated in larger cells, they also have an immortal soul. In animals the vital spirit has the body as its 'instrument' (*organum*); in man the vital spirit which springs 'from the wombs of the elements' is itself the instrument of the immaterial soul (25).

Bacon's trichotomy of spirits, first formulated in the *De viis mortis*, was thus the starting point for an attempt to impose theoretical order on the diversity of living and non-living forms, and to assimilate a commonplace regulative belief, the notion of the chain of being (26), to his theory of matter. Bacon had definite ideas about the sequence of biological links and about the factors governing their position in the chain. Ascent of the chain is a matter of increasing vitality, stability of form, diversity of internal structure and, in animals, sensory-motor sophistication (27). Above all, ascent is marked by increasing quantity and 'inflammation' of the vital spirit. In the last analysis, living things constitute a succession of forms in which higher beings have more vital spirit situated more spaciously than in lower ones. Every factor governing the position of a species in the chain is secondary to or depends on the nature of the spirit (28). Bacon therefore effectively annexed an old concept to new philosophy or, conversely, justified an aspect of his matter theory in terms of its capacity for explaining the fact of a natural hierarchy.

That at any rate is the case in the works of the *Instauratio*, but is it also true of the *De viis mortis*? The statements of the trichotomy in the *De viis* (fols.16r, 26v) at least carry the germs of the ideas

outlined above, but it is not altogether clear that Bacon had come to see the full explanatory potential of the trichotomy when he was revising Part A and writing Part B. The *De viis* lacks the profusion of references to specific plants and animals, and there is no evidence in the manuscript of any attempt to order living beings into an explicit, detailed hierarchy. The manuscript has nothing to say about the distinction between perfect and imperfect organisms, and tells us nothing about man's soul or his place in nature - though Bacon may perhaps have dealt with these topics had he embarked on the part of the work to which the drafts on folios 28 recto-29 verso may have been the introduction (29).

Nevertheless, by the time he revised and expanded the amanuensis' copy, he had come to realise that the trichotomy could be used as a basic framework for dealing with terrestrial phenomena. He had also reached the crucial stage of regarding the distinction between spirit branching and spirit branching with a cell as the source of the 'true differences' between the plant and animal kingdoms (fol.26v). But had he come to the conclusion that differences in 'inflammation' and volume of spirit were the sources of the primary differences between beings *within* those kingdoms? The evidence is inconclusive: he said nothing about differences of volume and, though keen to adduce evidence that vegetables did possess an inflamed spirit despite the fact that they were cold to the touch, spoke only of the differences of vital spirit as between plants and animals, and not as between plant and plant or animal and animal (fol.29v). Bacon had begun to project his positive science into new territory, and absorb the realm of biology into the speculative philosophy. However, in relation to the vital spirit and the trichotomy, one cannot know whether refinements of doctrine present in the later works were already in his mind when he wrote the *De viis mortis*.

(c) The powers of the vital spirit

In the *De viis* discussion of the faculties and powers which the vital spirit confers on its possessors is characteristically brief. The vital spirit maintains the integrity of the living body against the forces of dissolution represented chiefly by the inanimate spirits which, in the long run, invariably get the upper hand (fol.28v). Animals and plants derive their organised structure and capacity for nutrition and growth from the vital spirit. The spirit works more 'noble effects' in animals than in plants. By virtue of the spirit they have more diverse internal organs, the power to process food selectively, and consequently the faculty of excretion. Moreover, under the influence of the vital spirit concentrated in the cerebral cells, the vital spirit dispersed through the network of nerves expands and contracts; that gives rise to pulse and local motion. The 'passions'

of the spirit in the nerves are, in their turn, communicated to the spirit in the cells and that is the basis of 'sense and everything depending on sense' (fols.8v, 26v). However, the 'inflammation' of the vital spirit, the very thing that makes living beings what they are, carries penalties: plants and animals need nourishment not simply in order to grow but because the vital spirit itself preys upon the juices of their bodies. Animals, whose spirits are much more inflamed than those of plants, need respiration to keep the spirits' heat from becoming destructively strong (fols.2lr, 29r-v).

It is necessary, in order to make sense of these brief remarks, to turn once again to the works of the *Instauratio*. In those works Bacon did not discuss the role of vital spirit in plants, but he believed (no doubt) that the spirit was ultimately responsible for regulating the vegetative functions of plants *and* animals. According to the *Historia vitae et mortis:*

> Actions and functions of the individual members follow the nature of the members themselves; as attraction, retention, digestion, assimilation, excretion, perspiration ... depend upon the properties of the several organs, as the stomach, liver, heart, spleen, gall ... But yet none of these actions would ever be set in motion without the vigour, presence, and heat of the vital spirit (*neque tamen ulla ex ipsis actionibus unquam actuata foret, nisi ex vigore et praesentia spiritus vitalis et caloris ejus*); as iron could not attract iron, unless it were excited by the magnet; and an egg could not be productive, unless the substance of the hen had been actuated by the treading of the cock (30).

It seems then that the organs act 'locally' according to their own natures but are nevertheless energised and coordinated by the vital spirit, the 'master-wheel which turns the other wheels in the body' (31).

Organs responsible for the vegetative functions (nutrition, growth, maintenance, and so on) seem to act by 'perception', mere reaction to local stimuli. Such reactions occur, for instance, in the organs that convert food into the substance of the body, but the reactions are governed by the vital spirit (32). Moreover, the presence of the spirit is 'the only reason why inanimate bodies do not assimilate and animate bodies do' (33). One may suppose then that if Bacon had been asked about the functions of vital spirits in plants he would have gone beyond the statements in the *De viis* and argued that the spirits activated and regulated not just nutrition but all the activities that make plants different from inanimate objects.

The higher functions of vital spirit are exercised only in animals, in beings where the spirit exists not just in a branching network but also in a cell. In these conditions vital spirit mediates centrifugal motor functions and centripetal sensory ones. These

functions flow from the chemistry of the spirit. The spirit is, as the *De viis* and other works point out, an air-flame compound (34). Consequently it has (according to the *De augmentis*) the 'softness of air to receive impressions, and the vigour of fire to propagate its action' (35). From air the spirit derives (according to the *Historia vitae*) 'its easy and delicate impressions and receptions, but from flame its noble and powerful motions and activity' (36). In other words, the airy component is the sensory aspect of the vital spirit, the fiery component the motor aspect.

Bacon wrote very little about sensation (37), but he seems to have believed that the sense organs were largely passive instruments of the vital spirit. Yet they are not wholly passive since different sense organs 'qualify' the spirit's motions, 'and make so many several species of motions, and pleasures or displeasures thereupon, as there be diversities of organs'. These organs are built differently so that if there were 'other different organs, and qualified perforations for the spirits to pass, there would be more than the five senses' (38). The sense organs and the stimuli impinging upon them alter the vital spirit. The alteration or impression is conducted by the spirit through the nerves to the cell or ventricular concentration of spirit in the brain. There the impression borne by the spirit passes at first to something called 'sense' which 'is affected by individuals only'. 'Sense', the Baconian version of the Renaissance, medieval, and ultimately Galenic *sensus communis* (39), is simply vital spirit working in particular ventricular conditions. It synthesizes or unifies the impressions specific to each of the external senses and then passes the synthesized image to the memory which, like 'sense', is another ventricular concentration of spirit (40).

To initiate voluntary motion, an image stored in the memory is transferred to 'imagination' which is yet another concentration of spirit. Indeed, in animals the vital spirit is the substrate of all higher mental functions. Then, presumably, changes in the vital spirit of the imagination promote changes in the vital spirit in the nerves and 'canals of the sinews' thus causing voluntary motion. That, at any rate would be consistent with Bacon's view on human locomotion and with early seventeenth-century ideas about the functions of the mental faculties (41). The immediate causes of voluntary motion are 'the compressions, dilatations, and agitations of the spirit'; but how these

> can sway, excite, or impel the corporeal and gross mass of the parts, has not as yet been diligently inquired and handled. And no wonder; seeing the sensible soul [i.e. vital spirit] has been regarded rather as a function than as a substance. But since it is now known that it is itself a corporeal and material substance, it is necessary to inquire by what efforts a spirit so small and tender can put in motion bodies so gross and hard (42).

Apart from this attempt to divert research along implicitly anti-Aristotelian lines and assert a materialist conception of the spirit, Bacon carried this enquiry no further - except to suggest that the sheer vigour and velocity of the spirit allowed it to perform its function. But even then the spirit succeeds only because of the 'slowness of the bodily mass in exerting its resistance' (43).

The vital spirits in animals thus oversee the vegetative functions and mediate sensation and motion. The spirits concentrated in the cerebral ventricles endow animals with the faculties of sense, imagination and memory, faculties without which sensation and voluntary motion would be impossible. That is true for animals, but is it also true for human beings? The *De viis mortis* has nothing whatever to say about this exceedingly difficult question so it would not be appropriate to consider it here. Suffice it to say that Bacon probably thought that human voluntary motion, sensation, sense, imagination, memory, and even reason were all products of vital spirit operating in the nerves and ventricles of the brain. But if he thought that why did he claim repeatedly that human reason, imagination, and memory belonged to the incorporeal rational soul? A probable answer is that when speaking of the faculties of the immortal rational soul, he thought of the soul as an entity which somehow informed or acted upon ventricular concentrations of vital spirit corresponding to those faculties, and that the soul acted on these concentrations in such a way as to produce those higher attributes unique to human beings (44).

(d) Vital spirit: its maintenance and origin

Death invariably comes with the destruction of the vital spirit, and the spirit lasts only as long as it has 'suitable motion, moderate coolness, and proper aliment'. These three things 'are the proper and immediate passions of the spirit. For all the organs of the principal parts serve to perform these three offices; and again all destruction of organs which causes death brings it to this, that one or more of these fail' (45). That, at any rate, is the story in the *Historia vitae et mortis*. The *De viis mortis* mentions only two of these conditions for the persistence of the spirit - coolness and aliment (fols.26v, 29r-v). Nothing is said of the need for mobility, though it is implicit in the concept of vital spirit that without motion it could not fulfil its regulative and sensory-motor functions (46).

As for coolness, Bacon followed the traditional line (47) that the vital spirit of animals would destroy itself in its own heat if it were not refrigerated by respiration. That is the view advanced in the *De viis*, and it is a view to which later works added little (48).

The question of 'proper aliment' would have been one of the main issues considered in the *De viis* had the work been completed. Bacon regarded it as central to the business of prolonging life (fol.29v). In the first place, nourishment repairs and restores the organs that sustain the vital spirit. In particular it restores the vulnerable, drier, porous organs - arteries, bones, viscera - which suffer most from the predatory, desiccating actions of the inanimate spirit. Complete restoration, by nourishment or any other means, is impossible. At best, one can only conduct a fighting retreat against organic deterioration. By 'proper aliment' and a variety of other methods one can only delay but not prevent the eventual breakdown of vital bodily structures (49).

In the second place, nourishment is essential because the vital spirit itself draws upon the resources of the body (50). Bacon's views on this do not appear in the unfinished *De viis*, but elsewhere we discover that the rapid consumption of unnourished living organisms 'is the work of the living spirit which either repairs itself (*se reparat*) or makes it necessary for the parts to repair themselves or both'. The vital spirit is evidently repaired by the 'fresh and lively blood of the small arteries which are inserted into the brain (*ex sanguine vivido et florido arteriarum exilium, quae insinuantur in cerebrum*) but this repair takes place according to its own manner, whereof I am not now speaking' (51). So far so good: in line with an essentially Galenic view of the functions of the organs, Bacon seems to think that food is needed to create venous blood, that arterial blood is 'supplied' by venous blood, and that arterial blood repairs the vital spirit (52). But the cagey remarks at the end of the quotation leave doubts not stilled by Bacon's comparison of vital spirit with its components - air and flame. The spirit is not as permanent as air nor as temporary as flame. Flame is 'continually generated and extinguished, so that it is only continued by succession (*per successionem*)'. Therefore flame has to be fuelled incessantly. The spirit, on the contrary, 'subsists in identity, and not by succession or renovation (*in identitate, non per successionem aut renovationem*)' (53). But if that is the case why did Bacon think that it needed repair or nourishing? How can something that subsists in itself require sustenance? Although he called for further research into these matters (54), he did not supply answers to these particular questions.

So much then for the chemistry and functions of the vital spirit, and for the conditions necessary for its survival. Only one question remains: where does the spirit come from? The published works tell us virtually nothing about this. The *De augmentis scientiarum* hints darkly that the spirit springs from the 'wombs of the elements (*e matricibus elementorum*)' - a quasi-Paracelsian formulation which seems only to mean that the spirit is a material substance (55). The published works also assure us that vivification, the process that

converts non-living matter into a living being, begins with the motion of *inanimate* spirit in substances sticky or pliant enough to allow the spirit to move about without letting it escape. In such substances the inanimate spirit 'as it were inflates and thrusts them out into various figures; whence proceeds that same generation and organisation' (56). But only in the *De viis* is there the suggestion that vital spirit actually comes from inanimate, that vital spirit is inanimate spirit upgraded. It seems that in the right substances the discrete portions of inanimate spirit can actually join up to form a network of chanels and so become vital spirit (fol.26v). Since the vital spirit is more fiery than the inanimate, the organisational change is presumably accompanied by a qualitative one. But on this matter Bacon was silent. Since he believed in general that larger quantities of any substance could assume qualities other than those apparent in smaller quantities (57), perhaps he thought that the mere joining together of pockets of inanimate spirit would induce the gradual qualitative change necessary to convert it into the more fiery vital spirit. In vivifying inert matter and producing vital spirit, the inanimate spirit has creative functions. We shall see, however, that the activities of inanimate spirit tend, on the whole, to be thoroughly destructive.

Notes to Chapter 3

1 See ch. 5, sect. a.
2 "Works", I, 600, II, 106-7.
3 See ch. 4.
4 "Works", II, 106.
5 Ibid., 107, 195-6.
6 Fols. 28r, 29r. These opinions are stated at some length in the *Novum organum*: "And it is true that upon the anatomy of organised bodies (as of man and animals) some pains have been well bestowed and with good effect; and a subtle thing it seems to be, and a good scrutiny of nature. Yet this kind of anatomy is subject to sight and sense, and has place only in organised bodies.' But a profounder kind of anatomy should be undertaken 'by reasoning and true induction, with experiments to aid ... we must inquire what amount of spirit there is in every body ... the disposition of the spirit throughout the corporeal frame, with its pores, passages, veins and cells, and the rudiments or first essays of the organised body ...' ("Works", IV, 124-5; cf. I, 233-4). For a brief discussion of Bacon's metaphorical 'anatomies' see Rees, op. cit. (ch. 2, 9), pp.567-71.
7 The principal sources for the concept of vital spirit are the *Novum organum*, *Historia vitae et mortis*, *Historia densi et rari*, and *Sylva sylvarum*.

8 See Spedding, op. cit. (ch. 1, 11), I, 124-5.
9 "Works", III, 246, 464; also see III, 222, 396, V, 504, VI, 560, 671, 747.
10 Ibid., V, 432-3; cf. III, 28.
11 See ch. 4, sects. c-e.
12 "Works", V, 323; cf. II, 215; also see II, 528.
13 Ibid., I, 231, II, 262-3, 304.
14 Ibid., II, 529, 592-3. In the *Novum organum* Bacon calls such beings 'bordering instances' in that they 'seem to be composed of two species, or to be rudiments between one species and another' (ibid., IV, 169, cf. I, 283). Bacon's belief in 'quasi-animate beings' accords of course with his taste for intermediates (see ch. 2, sect. b) and with the Platonic principle of plentitude, a principle which was a key component in the idea complex known as the great chain of being. For the principle of plentitude see A. O. Lovejoy's celebrated study "The great chain of being", New York, 1936, repr. 1960; see also W. F. Bynum's discriminating appreciation of Lovejoy's work, 'The great chain of being after forty years: an appraisal', Hist. Sci., 1975, xiii, 1-28.
15 "Works", I, 283, 543-4, II, 264, 512, 515-16.
16 Even perfect plants have some degree of morphological plasticity; higher plants can degenerate into lower, see ibid., II, 506-7, 516, 547.
17 Ibid., I, 606-7, II, 130, 192, 351-2.
18 Ibid., II, 208, 215, 474, 557-60, 639.
19 Ibid., II, 639. According to the *Sylva sylvarum*, 'in living creatures that come of putrefaction, there is much transmutation of one into another; as caterpillars turn into flies, &c. And it should seem probable that whatsoever creature, having life, is generated without seed, that creature will change out of one species into another. For it is the seed, and the nature of it, which locketh and boundeth in the creature, that it doth not expatiate' (ibid., II, 507-8). However, many imperfect creatures once generated from putrefaction subsequently 'procreate by copulation' (ibid., II, 639). The 'bio-engineering' undertaken by fellows of Salomon's House seems to be based on assumptions of this kind, see ibid., III, 159.
20 Ibid., II, 560.
21 Ibid., I, 543-4, II, 531-2, 630-1.
22 Ibid., I, 544; also see I, 283.
23 Ibid., I, 525-6.
24 Ibid., I, 604-5.
25 Ibid., I, 604, 606-7, II, 214-15.
26 For the chain of being see note 14.
27 See "Works", II, 214-15.
28 See especially ibid., II, 528-31.
29 The part of *De viis mortis* that was to have been devoted to a consideration of animate beings *qua* animate. The unfinished manuscript deals, as has been said above, with factors causing ageing or dissolution in both animate and inanimate beings.
30 "Works", II, 215-16; also see 214.
31 Ibid., II, 221.

32 The *De viis* refers to 'perception' on fol.26v. *'Perceptio'* is considered in the *De augmentis*: 'Nor am I speaking only of the more subtle perceptions, as when the magnet attracts iron, flame leaps towards naphtha ... the body of an animal assimilates things that are useful and excerns things that are not so ... since no body when placed near another either changes it or is changed by it, unless a reciprocal perception precede the operation' ("Works", IV, 402; cf. I, 610). For the role of vital spirit in relation to the organs see ibid., I, 344.
33 Ibid., V, 304-5, cf. II, 197.
34 Fol.17v.
35 "Works", IV, 398; cf. I, 606.
36 Ibid., V, 335; cf. II, 225.
37 No clear view of the workings of each of the individual external senses (as distinct from sensation in general) can be derived from Bacon's extant works.
38 Ibid., II, 556; see also, 225.
39 Ibid., IV, 292-93; cf. I, 494-5. For *sensus communis* see R. E. Siegel, "Galen on psychology, psychopathology, and function and diseases of the nervous system", Basel, 1973, pp.137-8, 152; E. R. Harvey, "The inward wits: psychological theory in the Middle Ages and the Renaissance" (Warburg Institute Surveys VI), London, 1975, pp.23, 43-4, 54-5; K. R. Wallace, "Francis Bacon on the nature of man", Urbana, 1967, pp.64, 68. Wallace, in fact, denies that Bacon invoked or alluded to the faculty of 'sense', but he is mistaken. According to the *Sylva sylvarum* for instance, 'Sounds are meliorated by the intension of the sense; where common sense is collected most to the particular sense of hearing, and the sight suspended: and therefore sounds are sweeter (as well as greater) in the night than in the day' ("Works", II, 423). If, in other words, stimuli from one of the external senses are excluded, inputs from other senses will monopolise the synthesizing faculty. In short, Bacon not only believed that the faculty called 'common sense' existed, he also thought that it was an aspect of the vital spirit located in the cerebral cell.
40 Ibid., I, 494-5.
41 Ibid., I, 609-10; also see Harvey, op. cit. (39).
42 Ibid., IV, 401; cf. I, 609-10. For 'sensible soul' and other synonyms of 'vital spirit' see G. Rees, 'Francis Bacon and *spiritus vitalis*', in M. Fattori & M. Bianchi (eds.), *"Spiritus: atti del IV colloquio internazionale del Lessico Intellettuale Europeo"*, Rome, (forthcoming). This volume will also contain important papers by A. G. Debus, R. Hall, M. Fattori, D. P. Walker, et al.
43 "Works", I, 328.
44 For evidence relating to the relationship between the human rational soul and vital spirit see ibid., I, 494, 609-10, II, 225; see also Rees, op. cit. (42).
45 "Works", II, 203, 225.
46 For the causes and consequences of loss of motion see ibid., II, 203-4.

47 For the Aristotelian view that respiration refrigerates see W. D. Ross & J. A. Smith (eds.), "The works of Aristotle translated into English", 12 vols., Oxford, 1908-1952, III, 478a, 480a.
48 See fol.29v; also see "Works", II, 204-6.
49 For the vulnerable organs see fol.21r; also see general notes to the transcription, note 82. In connexion with the deterioration of the body, Bacon believed that while a creature was still growing it was wholly reparable; only after maturity did repair lag behind degeneration; see ch. 5, sect. a.
50 See fols.2v, 29r-v.
51 "Works", II, 205-6, 224-5.
52 Ibid., II, 206. Galen and the Galenists of Bacon's age thought that arterial blood in the *rete mirabile* or choroid plexus secreted the 'animal spirit' (*pneuma psychikon*) - the substance responsible for the activity of the entire nervous system; see Siegel, op. cit. (39), pp.38-9, 61-2; Harvey, op. cit. (39), pp.6-7. The Telesian, Agostino Doni, whose work Bacon knew, took a similar view: spirit in the cerebral ventricles and in the nerves evolves from *flos sanguinis*; L. de Franco, "*L'eretico Agostino Doni, medico et filosofo cosentino del '500. In appendice: A. Doni, De natura hominis*", Cosenza, 1973, p.326. Bacon does not say much about the functions of the organs, but what he does say reflects Galenic positions. For instance, he believed that the stomach converted food in 'chylus' which was in turn elaborated into blood in the liver, that urine, 'the whey of blood', was drawn off by the kidneys, that venous blood created in the liver nourished the tissues, and the blood of the veins supplied the blood of the arteries which (as we have seen) supplied the vital spirits; see "Works", II, 130, 180, 207, 358, 362, 613.
53 Ibid., II, 206. The vital spirit is therefore very like the heaven of the fixed stars. Not only is that heaven very like vital spirit in its chemical constitution, but it exists 'in identity'. Just as the vital spirit in man mediates between body and soul, so the stellar heaven is located between the rest of the physical universe and the empyrean; see ch. 2, sect. b.
54 "Works", II, 225; in the catalogue of histories appended to the *Parasceve*, a projected *Historia facultatum* was to be devoted, among other things, to the 'conversion of Blood and Flower of Blood into Spirit' (ibid., I, 407).
55 Ibid., I, 604. For the Paracelsian view of the elements as matrices, see ch. 2, sect. b.
56 "Works", II, 214; cf. fols.15v-15a r.
57 Ibid., I, 329.

4 Inanimate spirit and tangible matter

(a) Inanimate spirit: 1592-1626

The theory of attached inanimate spirits had begun to take shape in the early 1590s. By about 1592 Bacon had already accepted that spirits imprisoned in tangible matter wrought many of the processes observable in the zone of flux between the earth's interior and the celestial realm (1). But evidence available before the discovery of the Hardwick manuscript indicated that this seminal idea grew very little over the next twenty years, or was undergoing subterranean elaboration which only became fully apparent in the later years of Bacon's career.

The doctrine of inanimate spirits made a number of brief appearances in works written before the *De viis mortis*. For instance, by about 1604 when Bacon wrote the *Cogitationes de rerum natura*, he had developed the doctrine to the point where it could be used to explain the explosive force of gunpowder, and the differences between solids and liquids (2). Later still, in the *De principiis atque originibus* (161-?), he invoked the spirits to explain melting, hardening, and contraction in solids (3).

The first appearance of the theory in its biological applications occurs in The advancement of learning (1605). Here, for the first time, the theory became associated with the aim of prolonging life:

> It is more probable, that he that knoweth the nature of arefaction, the nature of assimilation of nourishment to the thing nourished, the manner of increase and clearing of spirits, the manner of the depredations which spirits make upon the humours and solid parts, shall by ambages of diets, bathings, anointings, medicines, motions, and the like, prolong life or restore some degree of youth or vivacity, than that it can be done with the use of a few drops or scruples of a liquor or receit (4).

Bacon had appropriated the ancient dream of prolonging life and used it as an archetype of the ambitious aims of a reconstructed, utilitarian philosophy before he wrote The advancement (5). But in The advancement two basic features of the programme for realising the aim appeared for the first time: namely, that the spirits prey upon

the body and undermine it, and that there were no short cuts to long life. The complex causes of ageing and death require complex treatments systematically applied, and no one need hope for a simple cure or miraculous elixir to do the job (6).

These ideas are taken further in the interpretation of the Proserpina myth in the *De sapientia veterum* (1609). Once again the vanity of the alchemical pedlars of false hope is deplored; once again the spirits are identified as wreckers of all terrestrial bodies, living and non-living. But for the first time, and in language of the kind later encountered in the Hardwick manuscript (7), Bacon indicates how the activities of the spirits may be curbed:

> There are two ways of confining and restraining spirit in solid and earthy matter; one by constipation and obstruction, which is simple imprisonment and violence; the other by administering some suitable aliment, which is spontaneous and free. For when the imprisoned spirit begins to feed and nourish itself, it is no longer in a hurry to escape, but becomes settled as in its own land. And this is what is meant by Proserpina's tasting of the pomegranate; which if she had not done, she would have been long since carried off by Ceres as she traversed the globe with her torch in quest of her. For though the spirit which is contained in metals and minerals is prevented from getting out chiefly perhaps by the solidity of the mass, that which is contained in plants and animals dwells in a porous body, from which it could easily escape if it were not by that process of tasting reconciled to remain (8).

So, by 1609, Bacon had stigmatized the inanimate spirits as principal agents of bodily dissolution, argued the necessity of an intricate regimen to restrain their depredations, and suggested that, given suitable materials to feed on, the spirits might more readily put up with their confinement in tangible matter (9).

That was practically all that he had to say about the biological role of inanimate spirit before the *De viis mortis* and the works of 1620 to 1626. The only possible exception to this is a short unpublished text entitled *Historia et inquisitio de animato et inanimato*, a text recently discovered in the *Bibliothèque Nationale*. This text contains material on, among other things, vivification - the creative function of inanimate spirit. However, the available evidence indicates strongly that this text belongs to Bacon's last years, and consequently that it was written after the *De viis mortis* (10). It follows then that the Hardwick manuscript marks a first flowering of the theory of attached spirits. There, for the first time, Bacon set out to elaborate the theory at length in its biological applications and, in particular, to give systematic expression to his ideas about the spirits' behaviour and the conditions affecting it.

Before the discovery of the manuscript one would have supposed that Bacon did no such thing before 1620; but now that supposition can no longer be made. The *De viis* marks a transitional stage between the brief, sporadic references to the theory in earlier works and the mature accounts of the 1620s. More specifically, it marks the point at which he began to broach the subject of prolonging life in earnest and work up the intellectual equipment which was ultimately to serve in the most extensive treatment of the subject, the *Historia vitae et mortis*. In short, the *De viis* may be regarded as a work which complements the *Thema coeli*. Just as the latter was Bacon's first systematic attempt to apply the pneumatic theory of matter to cosmological problems, so the former (once Part A had been revised) was his first organised attempt to extend the theory to biological ones.

(b) The *actio triplex*

In the *De viis* the material on inanimate spirits begins with a fairly substantial introduction (fols.1v-8r). The introduction, followed by a series of aphorisms, has three parts: a critique of rival views of ageing (fols.1v-2v), a discussion of processes causing disintegration (fols.2v-5v), and an account of the principal varieties of inanimate spirit, tangible matter and of the ways in which external factors affect spirit-tangible interactions (fols.5v-8r). When Bacon revised the amanuensis' copy, he rewrote and expanded this third section in its entirety, and that revision appears as the first item in Part B (fols.16r-18v). As for the aphorisms which make up the rest of the text, the ones in Part A (fols.8v-15a r) were extensively revised and expanded, and additional aphorisms were drawn up in Part B (fols.20r-27r) for insertion, as we have seen, amongst those in Part A (11).

Since the introduction contains the gist of much that is dealt with in the aphorisms, it would perhaps be worthwhile to consider it in detail and to remark on some of the aphoristic material in passing. Leaving the critique of rival ideas of ageing aside for the time being (12), let us start by looking at the section of the introduction concerned with the basic processes which eat away and eventually destroy all terrestrial things. The source of all disintegration is a fundamental *actio triplex* of the inanimate spirit. The successive stages of the *actio triplex* are attenuation, escape, and contraction. Attenuation takes place when the spirit attacks the tangible substances imprisoning it, and converts some of them into additional spirit. This weakens the structure of the object - be it living tissue or lifeless matter. It also makes the object lighter for, since spirit is weightless and tangible matter is not, the conversion of some of the latter into the former results in weight loss (fol.3v).

Attenuation is succeeded by the spirit's escape from tangible matter; for once the spirit has increased its volume and impaired the integrity of the tangible matter imprisoning it, it can decamp into the surrounding air (13). The departure of the spirit is followed by the last phase of the *actio triplex* - contraction. Bacon never believed that a vacuum could be created in nature (14), and so thought that the tangible parts of a body would close in to occupy the spaces left by the withdrawing spirit. This causes paper to wrinkle, the kernels in nuts to shrink in their shells, and timbers to split. Indeed, so severe can the effects of contraction become that objects break up and turn to dust (fols.3v-4r).

In the *De viis* and later works, knowledge of the *actio triplex* is represented as one of the essential preconditions for successfully dealing with the problem of preserving substances of all kinds. For instance, in one of the aphorisms in Part B of the manuscript Bacon indicated that bodies could be preserved by keeping them solid and compact so that their pores would be narrow enough to prevent undue emission of spirit (fol.24r). The *actio triplex* and its practical consequences are also considered in the *Novum organum* and *Historia vitae et mortis*. But in those and other late works the *actio triplex* is generally placed in the context of, or subordinated to a more powerful and comprehensive distinction which classifies effects according to whether they are caused by detention of the spirit, by its discharge, or by the curious mean state between detention and discharge, a state which promotes vivification. That more powerful distinction enabled Bacon to deal more effectively with activities of the spirit other than those involved in disintegration (15).

Even in the *De viis* the *actio triplex* does not stand entirely alone. In a brief passage transferred in the course of revision from folio 6 verso to a point on folio 5 recto immediately after the discussion of the *actio triplex* (16), Bacon observed that inanimate spirit was involved in the persistence of liquid mixtures, not just in attenuation and escape. Likewise, the tangible particles in such liquids tend to act in a way which has nothing to do with contraction. The various tangible particles in a liquid have a tendency to unite like with like, and that tendency brings about the disintegration of heterogeneous liquids. In fact these liquids are only kept in being by the presence of inanimate spirit which compels the heterogeneous particles to associate in a mixture. Once the spirit has escaped, liquids separate out into their component parts. This, according to an aphorism presented later in Part A (fols.14r-15r), is evident in composite liquids like blood, urine, and gravy. When the spirit deserts blood, the latter breaks down into water, dregs, and froth. A similar tripartite separation occurs in urine and gravy; the gross particles come together at the bottom of the container, the fatty ones unite in the middle, the watery ones collect at the top (fol. 14r-v). If, therefore, one wants to preserve liquids the spirit must be prevented from escaping (fol.15r).

(c) Inanimate spirit: its varieties and appetites

Bacon believed that the *actio triplex* and, presumably, the activities of spirit and tangible matter in liquids varied according to the natures and 'appetites' of the spirit, the tangible matter imprisoning it, and various ambient or environmental influences. In the amanuensis' copy, the discussion of these natures and appetites begins on folio 5 verso and ends on folio 8 recto. Bacon's extensive revised version of this discussion runs from folio 16 recto to folio 18 verso. The revised version is approximately 1000 words longer than the original 1300 word version copied up by the amanuensis. Taken together the two versions thus account for approximately 3500 words or a quarter of the entire manuscript.

The two versions differ significantly in organisation and content. From the point of view of organisation, the first version deals with six topics in the following order: with qualitative differences between (i) various sorts of spirits and (ii) tangible bodies, and with (iii) the effects of various ambient influences upon spirit-tangible matter interactions (fols.5v-7v); then come brief treatments of the appetites of (iv) the spirits, (v) tangible matter, and (vi) ambient influences (fols.7v-8r). In the revised version a clearer, more coherent structure is adopted. Discussion of the spirits' qualitative differences is followed by discussion of their appetites (fols.16v-17r); examination of the differences of tangible bodies is followed by an account of the appetites of those bodies (fols.17r-18r); and the revision ends with a reworked version (fol.18r-v) of the material on ambient influences. As Bacon reorganised the earlier version he also suppressed or relocated passages not strictly relevant to the matters in hand - as we shall see.

As for content, the revised version begins with an introductory section (fol.16r) not present in the original. This section sets forth and develops several fundamental propositions: that all tangible bodies on the surface of the earth contain imprisoned spirits, that these spirits are worked into tangible matter '*ex subactione et concoctione solis et coelestium*', and that the spirits themselves, though tenuous, are nevertheless thoroughly corporeal. The rest of the section is devoted to a concise treatment of the important trichotomy (spirit dispersed, branching, and branching with cellular concentration) (17). This added material seems to have been inserted the better to prepare the ground for the aphorisms which follow, and particularly for the detailed treatments of the same fundamental propositions which occur in the two great aphorisms (fols.22r, 25r, 26v) designed to stand at the start of the aphoristic section of the 'final' version of the *De viis* (18). The added material anticipates these aphorisms and, ultimately, the classic statements of general doctrine in *canones* II and IV of the *Historia vitae et mortis* (19).

The added material and the two Part B aphorisms which it anticipates provide further evidence of a concerted effort to raise the theoretical level of the discussion, and give authority and unity to detailed examination of the inanimate spirits' actions by explicitly setting it within a wider, systematic context. Part A in its original, unrevised form dealt almost entirely with the narrow topic of the spirits' role in the disintegration of solids. The revised text is a quite different animal. The narrow topic has been assimilated to the body of the speculative philosophy. The *actio triplex* has become associated, via the trichotomy, with the theory of vital spirit - a theory which appeared for the first time in the *De viis*. Inanimate and vital spirits are viewed as intermediates analogous to salt and, with the concept of salt, linked to sulphur and mercury and so (implicitly) to Bacon's cosmological thought (20). Something of the utmost importance seems to have taken place in the interval between the completion of the amanuensis' copy and completion of the revised and expanded text. In all probability that was the time when 'floating' components of the speculative system began to cohere - the biological with the non-biological, the terrestrial with the cosmological. If one wants to know when and how these crucial synaptic events took place, then the Hardwick manuscript is surely the text which must command one's attention.

Returning to more specific issues, we have seen that the revised treatment of conditions affecting the *actio triplex* begins with a highly theoretical statement (fol.16r) not found in the original Part A draft. It is also the case that the original begins with a passage (fols.5v-6r) not retained in the revised version. The passage distinguishes spirit left behind in remains of dead organisms and metals separated from their lodes from spirit introduced into gross matter by the action of fire. Although the passage contains ideas subsequently developed in some of the Part A aphorisms (fols.8v-9r, 14v), it may have been dropped in revision because Bacon wished to focus attention not on these distinctions but on what both versions identify as the cardinal differences between inanimate spirits (21).

According to the original and revised versions, the spirits differ principally in their intrinsic qualities and their distribution within tangible matter. Distribution varies in two ways: according to the size of the particles of spirit and the evenness of the spirits' dispersion through a tangible body. The size-evenness distinction is refined later in certain Part B aphorisms (fols.24r, 27r-v), and in two consecutive Part A aphorisms (fols.9v-11r). These two, prototypes perhaps of *canones* XII and XIII of the *Historia vitae* (22), were probably meant to follow the two great Part B aphorisms mentioned a moment ago, and their 'final' position no doubt indicates the importance that Bacon attached to them (23).

The first of the two Part A aphorisms deals with size, the second with evenness. It appears that spirit finely divided into very small portions is conducive to durability. In metals, for example, the gross parts break up the spirit into very small portions. In gums, on the contrary, the docility of the tangible parts keeps the spirit confined to small particles. The same is true of fatty and oily bodies, though not of watery ones. Watery bodies contain large particles of spirit and so are less durable (fols.9v-10r) for, as Bacon remarks in an interpolation added as he revised the aphorism (fol.10v), the larger the concentrations of spirit the more active it becomes, and that hastens dissolution. As for evenness, the greater it is the more durable the body. Even dispersion of spirit through tangible matter is usually found only in man-made objects produced, like bricks and tile, by strong, constant heat. Such objects are by virtue of even dispersion much more durable than natural bodies. In the latter, the extreme variability of the heat of the heavenly bodies makes the distribution of spirit very uneven (fol.10v) and, as Bacon was later to say in the *Historia vitae*, 'inequality is the mother of dissolution' (24). However, a beneficial dispersion of spirit in living bodies can be achieved, as Bacon explains in an interpolation inserted into the amanuensis' copy, by massage and so forth (fol.11r).

Turning now from evenness and size to the spirits' intrinsic qualities, the original version only tells us that some spirits are lively, sharp, and robust and others weaker and duller (fol.5v). The revised version with its more theoretical bias adds that spirits are air-fire compounds, and that they vary in their airiness or fieriness, and in density and rarity. It also adds that the spirits' actions are excited by heat, motion, and union with similar spirits; that they are calmed down by rest, and reduction of bulk; and that they receive 'illegitimate' or extrinsic stimulation when irritated by hostile bodies, and 'illegitimate' calming when approached by friendly ones (fols.16v-17r). All these points are elaborated *passim* in the Part A aphorisms and especially in the ones which appear in Part B. For instance, in an aphorism drafted on folio 23 recto, Bacon speaks of the inconvenience of sharp and mobile spirits. Like flames, such spirits are very predacious, and so spirited and fiery animals tend to have short lives. But according to another Part B aphorism, even sharp spirit tends to act sluggishly where its quantity is small. Thus in animals longevity can be promoted with foods that keep the spirit meagre (fol.27r). There is no doubt that Bacon also intended to draft further aphorisms on the topics mentioned on folios 16 verso to 17 recto, but he abandoned the manuscript before so doing (25).

As for the fundamental appetites, desires, or impulses of the spirit, the impulses which give rise to the *actio triplex*, the original Part A version merely lists them. The spirits love to (i) exercise their nature by motion and agitation, (ii) multiply themselves, and

(iii) escape from their tangible prisons and unite with cognate bodies (fol.7v). The revised version amplifies this bare list (fol.17r). The first appetite is a simple reaction against confinement in gross matter. In terms found nowhere else in his writings (26), Bacon actually characterises it. The spirit, like a demented prisoner, hurls itself against the walls of its tangible prison and rebounds from them, and this beating or pulsation *(pulsatio)* gradually but irresistibly breaks them down. This process is aided by the spirit's second impulse - to multiply and so conserve itself by converting susceptible parts of the tangible body into more spirit. The third impulse is the desire to unite with cognate bodies, especially air. This desire incites the spirit to escape. Escape is a prime enemy of durability in inanimate bodies, and longevity in living ones so conditions working against the urge to escape are of the utmost importance. A compact body with narrow pores will resist that urge in the same way as vessels with small perforations will not allow water to escape. Likewise, if the spirit is enclosed in 'friendly' tangible substances it will be less vulnerable to the seductions of external cognate bodies, and the urge to escape will be reduced still more if there is plenty of suitable matter in the tangible body which the spirit can multiply itself upon (fol.17r).

As one might expect, many of these points were extensively developed in aphoristic form. That is especially true of the points relating to conditions that restrain the spirit. In the Part A aphorisms we learn of the desirability of the spirit being surrounded by gross matter qualitatively similar to the spirit. In that situation the spirit stays passive and loses the urge to escape or multiply itself (fols.10v-11r). The risks of multiplying to such an abundance that putrefaction sets in suggests that objects are best preserved in substances which allow for gradual transpiration of spirit yet prevent rapid escape (fols.12v-13r). But, above all, the revised treatment of the appetites or impulses of spirit can be related to aphorisms projected but never drafted - especially the aphorisms listed on folio 19 verso, the ones endorsed 'δ', 'θ', 'ν', 'Π' and, most of all, 'μ': *'spiritus appetitus primus et potior est fruendi natura sua ...; secundus et minor se servandi et multiplicandi; tertius se uniandi'*. Had the *explicatio* of this aphorism been drafted, it would doubtless have been as a full amplification of the doctrine concerning the appetites of the spirit set out in the revised version of the treatment of that topic. Thus, in revising the introductory section of the *De viis*, Bacon aimed to do two things: to integrate the original materials into a wider theoretical structure, and to prepare the ground more thoroughly not just for the Part A aphorisms but for the ones in Part B, and for some planned but not drafted with a full *explicatio* when the text was abandoned.

(d) Tangible matter: its varieties and appetites

The discussion of tangible matter in Part A (fols.6r-v, 7v-8r) is very different from the revised one in Part B (fols.17r-18r). The Part A version begins by showing how the *actio triplex* is affected by the spirits' kinship with the tangible matter enveloping them. This was left out in the revision because the subject had already been touched on, as we have seen, in the revised treatment of the appetites of inanimate spirit (fol.17r). The Part A version continues with an afterthought (fol.6v) concerning the roles of spirit and tangible matter in heterogeneous liquids. That too was omitted from the revised discussion of tangible matter and was, as we know, transferred to its proper place immediately after the discussion of the *actio triplex* (fol.5r).

In fact, the revised account of the *varieties* of tangible matter retains only one feature of the original - the distinction between 'similar' and 'dissimilar' tangible bodies (fol.6v). As for the revised treatment of the *appetites* of tangible matter (fols.17v-18r), it retained what little the original (fols.7v-8r) had to say on the subject - that contraction depends on two appetites: the desire to avoid a vacuum, and the impulse which causes tangible particles to 'close ranks' to avoid complete annihilation by the spirits.

The scanty materials which Bacon chose to retain were incorporated in a much more substantial revised account of the varieties and appetites of tangible matter. The revised account is important because it brings together elements of an idea complex which was to become very prominent in later works (27), as will be seen shortly. According to the revised account, tangible bodies may be differentiated in terms of four major polarities: dense, rare; solid, liquid; crude, fat; similar, dissimilar. In connexion with the first polarity, Bacon rejected the scholastic view of matter as 'abstract or potential' (a criticism vigorously repeated in later works) (28), and defined dense bodies as ones containing more matter in a given volume, and rare ones as containing less. As for solids and liquids Bacon argued, in line with principles developed elsewhere in the manuscript (29), that liquids contained a plentiful spirit evenly diffused through the tangible mass whereas solids possessed much less spirit less evenly distributed (fol.17r).

The distinction between fat and crude substances opens the way for statements of fundamental doctrine, for these substances '*sunt illa duo primae corporum texturae, et maximae rerum familiae*'. Here Bacon is unquestionably thinking of these substances as representatives of their respective families - the sulphur and mercury quaternions (30). He explains that fat and crude bodies differ in that fat are inflammable, and crude are not; and he repudiates the Paracelsian

concept of salt (31). Salt is not one of three sophic principles but a compound of sulphur and mercury, the archetypal fat and crude substances. It has parts which 'conceive flame and parts which shrink from it'. It is a 'rudiment' of life, for all vital spirit or 'breath of life' is an air-flame compound (fol.17r-v). Most of these points are made in later works, and in much the same order (32). But the Hardwick account represents the first extant attempt to integrate beliefs about salt and vital spirit with the theory of the two quaternions. The account is also unique; other works tell us about various connexions between various intermediates (33), but only the *De viis mortis* tells us that salt is an analogue or low-grade version of vital spirit.

The last of the four dichotomies, similar-dissimilar, is the only one mentioned in the Part A treatment of tangible matter (fol.6v), and only the Part B version explains it (fol.17v). 'Similar' bodies are homogeneous and lack internal structure. Distillation products are 'similar' (34) but the so-called similar parts of living beings are not (35). The latter are 'obviously organic, figured, and integral (which is the ultimate limit of dissimilarity)'. So what is an 'integral' body? The *De viis mortis* gives no clear answer, but the *Abecedarium novum naturae* (1622) does. The *Abecedarium* has two dichotomies where the Hardwick manuscript had one. The two are similar-dissimilar and integral-not integral. It appears that the first dichotomy applies only to parts of an object considered in themselves. The second refers to the relationship between parts. Integral bodies exhibit functional relationships between structurally complex (dissimilar) parts or organs (36). That is presumably what the *De viis* means when the integral state is represented as the ultimate limit of dissimilarity, '*et quasi machina quaedam*' (fol.17v).

The tendency of distinctions in the Hardwick manuscript to proliferate by subdivision when they reappear in later works manifests itself in an acute form in the case of the appetites of tangible matter. Part A merely states that contraction arises from the tangible parts' desire to preserve their own nature (fols.7v-8r). These appetites are considered more fully in the revised version - along with three others: rest, motion to a homogeneous substance, and avoidance of preternatural compression or stretching (fols.17v-18r). In the later works, aspects of these appetites are separated out and treated as distinct topics. In connexion with rest, for instance, the manuscript says that all tangible matter shrinks from local motion except motion to the mass of kindred substances, i.e. motion of gravity (fol.17v). In the extended discussions of motion in the *Novum organum* and *Abecedarium*, these two aspects are considered under separate headings: the tendency to remain at rest under '*motus decubitus*', motion of gravity under '*motus congregationis majoris*' (37).

According to the manuscript, resistance to local motion is so strong that it even overcomes the tendency of homogeneous substances in a compound to separate and for their particles to join together like with like. Only in liquids full of spirit, or in solids whose spirit has been excited do the particles of a composite body separate out and group according to their kinds - though sometimes a strong spirit can have the opposite effect and hold heterogeneous particles together, their natural desire to unite like with like notwithstanding (fols.17v-18r). Aspects of these issues reemerge in the discussions of *'motus decubitus'*, *'motus congregationis minoris'*, and *'motus regius'* in the *Novum organum* and *Abecedarium* (38). In similar fashion, the manuscript account of the tendencies to avoid a vacuum and preternatural compression on stretching reappears in an expanded form in the treatments of *'motus nexus'*, *'motus libertatis'*, and *'motus hyles'* in the two late works (39).

What then does the revised treatment of the states and appetites of tangible matter amount to? It amounts to the birth of a new grouping of ideas. The discussion of the four dichotomies constitutes one half of the grouping; the other is the discussion of the appetites of tangible matter. In the revised treatment, the two halves come together for the first time. This grouping was to become a stable and highly important feature in some of the works belonging to the *Instauratio magna*. The dichotomies of the manuscript turn up among the crowd of dichotomies, 'schematisms' or 'primary elements of nature' (40) described in the *Abecedarium* and listed in the *De augmentis scientiarum* (41). Aspects of the appetites considered in Part B of the manuscript turn out to be embodied in seven of the nineteen 'simple motions' extensively examined in the *Novum organum*, of the sixteen described in the *Abecedarium*, and of the fifteen listed in the *De augmentis* (42). Of course, the manuscript and later works differ in terminology. 'Schematisms', 'simple motions', and the specific titles later accorded to each of the simple motions just do not occur in the *De viis*; and that is a further indication that the manuscript was not produced during the last years of Bacon's life. But terminological differences cannot mask the fact that the *De viis* contains the seed of an idea complex whose potential was most fully realised in the *Abecedarium*, the introduction to Part Four of the *Instauratio* (43). In that work the two halves of the complex were developed and extended to such a degree that they constituted a comprehensive, exhaustive survey of all the fundamental natures and motions which, if thoroughly investigated, would provide natural philosophy with a complete body of 'abstract physics' (44). With this physics would come 'the ability to decode nature's deeper structures' (45) and knowledge of all the letters of the alphabet necessary for constructing the 'syllables', 'words' and 'sentences' of the new philosophy (46).

It almost goes without saying that the emergence of this complex is typical of what was going on as Bacon revised Part A and drafted Part B: the connective tissues of his philosophy were being strengthened; distinctions were being refined and multiplied (as in the revised treatment of the differences and appetites of tangible matter); higher levels of theoretical integration were being achieved (as in the doctrine of intermediates); and, generally, a theoretical framework capable of relating particular phenomena and 'local' explanations to each other, and to the broad range of Bacon's speculative enthusiasms was being fashioned. In these ways, the transition from Part A to its revision and the writing of Part B marks a turning point between what Bacon had achieved by about 1612 and what he was to accomplish from 1620 onwards.

Moreover, the revised treatment of the differences and appetites of tangible matter shows, as does the rest of the revision of the non-aphoristic introduction of the *De viis*, Bacon's evident wish to expose plainly principles and assumptions implicit in the aphorisms of Parts A and B. For instance, by drawing attention to the crude-fat dichotomy he was laying foundations for, *inter alia*, discussion of the propositions that tangible parts of animal bodies were oil-water compounds (fols.11v-12r), that oily substances were more durable than crude (fol.10r-v), and consequently that oily foods help to prolong life by keeping down the quantity of inanimate spirit (fol.27r). Again, by introducing the dense-rare dichotomy Bacon was implicitly preparing the ground for '*Aphorismus* 1' of Part B where he was to distinguish between tangible bodies and their attached spirits in terms of their respective density and rarity (fols. 22r, 25r). Discussion of that dichotomy also anticipated '*Aphorismus* 9' in Part B where the relative densities of inanimate spirit, flame, and air were considered (fol.24r). In that same aphorism Bacon also attempted an explanation of the action of cupping glasses in terms of condensation and rarefaction, and of the tendency in tangible matter to resist the formation of a vacuum (47). That tendency had, of course, been discussed in the revised treatment of the appetites of tangible matter - no doubt in preparation for this very aphorism.

(e) Ambient influences

The revised version of the introductory section of the text ends with a passage on the effect of environmental or external influences affecting the *actio triplex* (fol.18r-v). Bacon produced the revised version by bringing together and reorganising two passages in the original (fols.7r, 8r). From the point of view of content, the two versions differ in no substantial respect. No doubt Bacon thought that the ideas expressed in the original would still serve as adequate preparation for aphorisms in the revised *De viis* which were to touch on the question of ambient influences.

But this should not lead one to underestimate the importance of these influences for Bacon's proposals for prolonging life. In the original (fol.7v) and revised (fol.18v) drafts, he insisted that knowledge of ambient influences could do more even than knowledge of tangible matter and spirit in the practical business of finding means for arresting decay and disintegration. Such influences help or hinder the *actio triplex*, and so advance or retard the disintegration of material objects. The principal external factors are these: (i) substances surrounding the tangible body and its imprisoned spirits; (ii) heat and cold; (iii) agitation and rest; (iv) fluctuations or changes in the other three.

The effects of (i) seem to be especially important. Substances surrounding tangible objects condense or attenuate them, contract or relax their pores, extract or entice substances from within them, impress their natures upon them, and so forth (fols.7v, 8r, 18v). These effects are referred to time and time again elsewhere in the manuscript. Fire, which Bacon of course regarded as a corporeal substance, has profound effects on tangible-pneumatic interactions. In metals, it incites the spirits and relaxes tangible matter and so causes melting; in clay, it drives the spirits out and produces brick; in meat and other foodstuffs, it seals their outer layers and so helps to preserve them (fols.9v, 10v-11v, 12r).

However, air is the most important external substance as far as disintegration is concerned. As has been seen, inanimate spirit is an air-flame compound in which air is the dominant component (48), so the spirit always seeks to unite with the external air. It is abetted in this by the air itself which constantly entices the spirit from tangible matter. Bacon not only advanced these propositions in the introduction to the *De viis mortis* (fols.3v-4r), he also repeated them again and again (fols.19v, 20v) - especially in '*Aphorismus* 6' of Part B (fol.27r). Elsewhere he considered the consequences of these views. Water, wine, and other liquids will only last if kept in well-sealed bottles (fols.12r, 15r); solids are best preserved with paint, pitch or gum, and even human beings can benefit from a lick of paint - as the example of the Ancient Britons and American Indians suggests (fols.12v-13v).

In essence, it is crucial to the durability of non-living things, and longevity in living bodies that a barrier be placed between the air and the object to be preserved. Such a barrier will reduce the evil consequences of the conspiracy between air and inanimate spirit. Nevertheless, a barrier must not be entirely impermeable lest the spirits' desire to multiply themselves results in the production of a dangerous excess of spirit in the tissues. Excess spirit must be allowed to escape gradually, and controlled transpiration can be achieved by placing semi-permeable barriers between an object and the surrounding air. Fruit, for example, is better stored in sand,

flour or powder than it is when coated with wax. These notions must, of course, be borne in mind in connexion with the prolongation of human life; for 'infinite helps and remedies' can be derived from knowledge of means of detaining the spirits, so long as one knows how to ward off potentially damaging multiplication of spirit (fol.13r-v).

Bacon took these ideas very seriously. That is evident in his slightly bizarre recommendation, in a later work, that lightly-oiled underclothes would help fend off the deleterious effects of the conspiracy between air and spirit (49). All the same, even that clammy thought follows quite naturally from fundamental doctrines of the *De viis mortis*: that living bodies are vulnerable to the same processes of decay as non-living ones, and that manipulation of the environmental or ambient conditions in which tangible matter interacts with inanimate spirit can profoundly influence the durability of corporeal things, human or otherwise.

On the subject of practical recommendations, it is perhaps worth making one or two further points. Much of what might usefully be said about the contents of the aphorisms has already been said in this and earlier chapters. But if one looks at the aphorisms by themselves, and particularly at the ones in Part A, an important fact emerges: that in revising Part B, Bacon gave the aphorisms a pronounced practical or utilitarian dimension - a dimension absent from the amanuensis' draft. Material added to the Part A aphorisms was almost entirely of a practical nature. This material, introduced in the form of extensive marginal interpolations, draws out the practical implications of the theoretical positions developed in the aphorisms. Thus to prevent adventitious spirits from corrupting the inanimate spirits residing in the tissues, the former should be voided (in the case of vegetables) by exposure to air or (in the case of animals) by working up a moderate sweat (fol.8v). Inanimate spirit can be kept in small concentrations and relatively inactive by exercise and astringent medicines (fol.10v), while massage and simple diet ensure the spirits' even dispersion (fol.11r). Diet is also useful for calming the spirits and damping down the *actio triplex* (fols.11v-12r).

Since Bacon built similar advice into some of the Part B aphorisms (fols.23r, 24r, 27r), one can hardly avoid the conclusion that these Part A revisions were consequences of a deliberate policy aimed at demonstrating the operative promise of his science. Thus, extensive organisational changes apart, the business of revision (taken broadly) projected the text along divergent but complementary paths - towards higher levels of theoretical integration, and towards some partial revelation of the fruits of speculation, of the means of prolonging life.

Notes to Chapter 4

1 Spedding, op. cit. (ch. 1, 11), I, 125-6.
2 "Works", III, 24-5, 32.
3 Ibid., III, 109.
4 Ibid., III, 362.
5 Ibid., III, 222.
6 For other instances of Bacon's contempt for simple nostrums see ibid., I, 559, II, 159-60.
7 Fols.9v, 11v, 14v, 29r.
8 "Works", VI, 760.
9 These topics are touched on in the manuscript *passim*.
10 The *Historia et inquisitio de animato et inanimato* forms part (fols. 5r-8r) of the *Bibliothèque Nationale* manuscript designated *fonds français* no 4745. The manuscript also contains a version of the *Historia densi et rari* (fols.9r-38v) and the complete text of the *Abecedarium novum naturae* (fols.39r-62r). The *Historia densi* and *Abecedarium* are late works and, for that and other reasons, I am inclined to think that the *Historia et inquisitio* is a late piece. The question of the date of the *Historia et inquisitio* will be examined fully in a forthcoming paper: Rees, op. cit. (ch. 1, 1).
11 See ch. 1, sect. b.
12 See ch. 5, sect. a.
13 For the spirit's relationship with air see ch. 2, sect. b, and ch. 4, sect. e.
14 For Bacon's views on this question see Rees, op. cit. (ch. 2, 9), pp.556-61.
15 See "Works", I, 310-11, II, 213-14, 451.
16 The transfer of material from fol.6v to fol.5r took place before Bacon decided to undertake a complete revision (fols.15r-18v) of fols.5v-8r.
17 For the trichotomy see ch. 3, sect. b.
18 See ch. 1, sect. b.
19 "Works", II, 213, 214-15.
20 See fol.17r-v; also see ch. 4, sect. d.
21 Bacon may also have omitted the passage because it contained the assertion that bricks became hard as a result of spirit added to the clay in the firing. He may have changed his mind about this by the time he began the revision; later works suggest that the hardness of brick results from the expulsion of spirit in the firing, see for instance "Works", II, 213.
22 Ibid., II, 218-19.
23 See ch. 1, sect. b for the position of these aphorisms in the revised sequence.
24 "Works", II, 219.
25 See fols.19v, 20r.
26 In other places, Bacon does not characterise the first appetite; he pays much more attention to the second appetite, see "Works", I, 310, 340, II, 119-20, 254-5, 282.

27 Notably in the *De augmentis* (ibid., II, 560-1), and the *Abecedarium*, op. cit.(10), *passim*.
28 "Works", I, 173-4, II, 243.
29 Fols.12r, 14r, 27v.
30 Bacon's use of the 'family' metaphor in connexion with the two quaternions was virtually automatic. In the *Thema coeli* the quaternions are '*duae rerum magnae familiae*' ("Works", III, 769); in the *Novum organum*, '*magnae rerum tribus*' (ibid., I, 359-60); in the preface of the projected *Historia sulphuris*, '*duae rerum tribus magnae*' (ibid., II, 82-3). In the *Sylva sylvarum* sulphur and mercury are called the 'fathers of their tribes' (ibid., II, 459).
31 For Bacon's rejection of the Paracelsian view of salt see Rees, op. cit. (ch. 2, 13), p.88.
32 See note 30.
33 Notably the *Historia vitae* ("Works", II, 120, 213, 216), and the *Sylva sylvarum* (ibid., II, 539-40, 624). Also see Rees, op. cit. (ch. 2, 20), pp.116-17.
34 For a restatement of this view see "Works", I, 233-4.
35 Bacon is here rejecting the Aristotelian notion of 'similar' (uniform) parts of animals. For Aristotle's view see "*Historia animalium*', ed. & tr. A. L. Peck, 3 vols., London, 1965, I, 2-5; "Generations of animals", ed. & tr. A. L. Peck, London, 1953, pp.77-9.
36 *Abecedarium*, op. cit.(10), fol.45r.
37 Ibid., fols.49v, 52r-v; "Works", I, 334-5, 346.
38 Ibid., I, 334-5, 336; *Abecedarium*, op. cit.(10), fols.49v-50r, 51v-52v.
39 "Works", I, 330-2; *Abecedarium*, op. cit.(10), fols.47v-48r.
40 They are called 'primary elements of nature (*naturae primordia*)' in the *Distributio operis* ("Works", I, 142).
41 Ibid., I, 560; *Abecedarium*, op. cit.(10), fols.39r-47v.
42 "Works", I, 330-46, 560-1; *Abecedarium*, op. cit.(10), fols.47r-52v.
43 Ibid., fol.39r-v: '*Pertinet autem Abecedarium ad Instaurationis partem quartam quae est scala sive machina intellectus; neque tamen est vera scala sed quasi ad eam. Omnino enim non suppetit mihi Instaurationem et experimentorum copia ad veram scalam; utilius autem indicavi opus urgere et promovere in multis quam perficere in paucis.*'
44 See "Works", I, 560-1.
45 H. Wheeler, 'The invention of modern empiricism: the juridical foundations of Francis Bacon's philosophy of science' (The 1983 Memorial Lecture delivered at the Francis Bacon Library, Claremont, California), unpublished typescript, p.33.
46 See *Abecedarium*, op. cit.(10), fol.47r-v.
47 For other references to the action of cupping glasses see "Works", I, 351-2, II, 267; also see Rees, op. cit. (ch. 2, 9), p.560.
48 Ch. 2, sect. b.
49 "Works", II, 180.

5 The *De viis* in context

(a) The prolongation of life

For Bacon, the aim of prolonging life may be said to represent the aims of his science as a whole. Confident that he lived in an age ordained by Providence for spectacular advances in knowledge (1), Bacon believed that a new science could accomplish a colossal improvement in the material conditions of mankind, restore the material felicity enjoyed by Adam and Eve, and repair the consequences of the Fall. The aim of the new science,

> is a restitution and reinvesting (in great part) of man to the sovereignty and power (for whensoever he shall be able to call the creatures by their true names he shall again command them) which he had in his first state of creation. And to speak plainly and clearly, it is a discovery of all operations and possibilities of operations from immortality (if it were possible) to the meanest mechanical practice (2).

It is no accident that here, and in the list of *magnalia* appended to the New Atlantis (3), Bacon marked out the prolongation of life as the first and highest objective of the new philosophy. Successful realisation of that ancient dream would be an outstanding fulfilment of a programme which proposed a proto-salvation, a material soteriology for this world (4).

As might be expected, Bacon did not imagine that success in prolonging life could be achieved by following the prescriptions of the ancients, or the doctrines of more recent writers who had 'handled the argument superstitiously and idly' (5). Bacon had read the work of a wide range of authorities on the subject. He had some acquaintance with the writings of, for instance, Aristotle, Galen, Avicenna, Albertus Magnus, Roger Bacon, Arnaldus de Villanova, Ficino, Paracelsus and the iatrochemists, Fernel, Cornaro, and Telesio (6). But in the opening pages of the *De viis*, where Bacon commented on rival theories, only Telesio is mentioned by name. In these pages Bacon promoted Telesio's ideas at the expense of the dominant tradition of ideas on ageing and death, but then went on to reject Telesio's views on the ground that they did not go far enough (fols.1v-2v).

In Bacon's age, the dominant tradition was that which stemmed back to Avicenna (980-1037) and, beyond him, to Aristotle and Galen (7). A great systematiser and synthesiser, Avicenna drew on classical tradition and its elaborations - elaborations of the kind represented in the work of Isaac Israeli (d932), and Ali ibn al-Abbas (d994) (8). With regard to the processes of ageing and death, Avicenna's theory was a refinement of ultimately Galenic ideas concerning the nutritive moistures or humours (9).

According to the theory, food undergoes two successive digestions, one in the stomach, the other in the liver. In Galenic fashion, the first digestion converts the nutritious parts of raw food into chyle which is converted by the second digestion into venous blood. Venous blood is transported from the liver to all parts of the body, and is assimilated to the parts by a third digestion. The third digestion is a complex process involving four nutrimental moistures. To distinguish them from the primary, Galenic quartet (blood, phlegm, black bile, and yellow bile), these four are called the 'secondary humours'. The first of the secondary humours becomes a dewy moisture or *ros* which acts either as a 'quasi-nutriment' for the tissues (10), or as a means of moistening them if they dry out. The *ros* can also turn into a third more viscous, solidified humour or *cambium*. *Cambium* is converted either into tissue solids or into the fourth secondary humour - the radical moisture or *gluten* which maintains the continuity and integrity of the parts (11).

The radical moisture is the key to Avicenna's treatment of the processes of ageing and death. This moisture is derived, though Avicenna does not say how, from sperm. It exists in a fixed quantity and it is this that determines an individual's life-span, for as time passes the radical moisture is consumed and desiccated by the innate heat (*calor innatus*). The innate or connatural heat is the instrument of the life soul and source of activity in the body. It governs the primary humours and inhibits putrefaction and dissolution within them (12). Natural death is the extinction of the innate heat. As a living being ages, the innate heat diminishes as it dries up and consumes the radical moisture. The older the individual, the drier and colder does his temperament become. In essence death occurs because the innate heat commits suicide by degrees; it dies down by gradually destroying the source of its own substance. Deploying a version of an image that was commonplace in discussions of ageing and death (13), Avicenna likened the radical moisture to the moisture holding together the fibres of a lamp's wick. This moisture is consumed by the flame but it is also replenished by oil from the lamp. Eventually, however, the wick becomes too dry to absorb oil. In the same manner the innate heat desiccates the tissues and consumes the radical moisture to a point where the organs can no longer absorb *ros* or *cambium*; and although the radical moisture is capable of some replenishment, it cannot be renewed indefinitely. Because of the

ever-diminishing heat available for the digestive processes, such restoration as the radical humour receives is increasingly imperfect (14).

Disseminated through Gerard of Cremona's twelfth-century Latin translation of the Avicennan *summa*, these views were broadly accepted by most medieval and Renaissance philosophers and physicians. These views were propagated, interpreted and elaborated by (among others) Cardinalis, Peter of Spain, Bernard of Gordon, Aquinas, Laurent Joubert (15) and by most of the post-classical writers on ageing whose works were known to Francis Bacon. In fact, the radical moisture theory only began to go out of fashion during the seventeenth century - perhaps as a result in part of Bacon's strictures (16).

As far as the *De viis mortis* is concerned, Bacon's attack on received doctrine is an intricate four-stage affair. He describes the radical moisture theory, contrasts it unfavourably with Telesio's, adds some obscure criticisms of the former, and then draws attention to the defects of the latter (fols.1v-2v). The third stage of the argument is rather problematic, so that will be examined after the other three.

Bacon pointed out, briefly but accurately, that the Arabo-Latin theory supposed that ageing and death were effects of the ineluctable diminution of 'natural heat', and radical or (perhaps echoing Fernel) 'primigenial' moisture of the body (17). The wasting away of radical moisture can of course be slowed down but never entirely checked or reversed by nutrition. This, according to Bacon, is a 'deficiency' theory of ageing; it is therefore very different from Telesio's 'superfluity' theory.

Telesio's theory, expressed in his *De rerum natura* (1586), is quite straightforward. From birth the condition and growth rate of the body vary with the condition of the blood which nourishes it. The condition of the blood is in turn governed by the state of the liver and the intensity of the body's heat. Telesio rejected the chilling traditional view that body heat diminished with age; instead, he conceived the cheerful thought that it gradually increased, and slowly but surely baked the liver. The parching of the liver does little to increase its efficiency. As time passes, the quality of the blood manufactured by the liver from chyle insensibly deteriorates. At the beginning of life the liver is extremely soft and sweet. It has a reddish colour tending more to white than black, and it produces pure, fresh blood very similar in its qualities to the flesh that it nourishes; that promotes growth. Growth slows down and eventually stops as body heat increases and damages the liver. The weak digestion of old men should not be attributed to declining heat. On the contrary, growing body heat makes the liver hard, gross, bitter, and black. That inhibits the conversion of chyle into blood, and the blood produced

by old men becomes thick and impure and increasingly incapable of nourishing the body. Instead of receiving suitable nourishment, the body becomes progressively encumbered with salty and bilious excrements; death then supervenes (18).

In a neat summary in the *De viis mortis*, Bacon captured the essence of this theory. The summary (fols.1v-2r) suggests clear understanding - which is exactly what one would expect of a man who was not only intimately acquainted with Telesio's philosophy but had also read similar theories in the work of Agostino Doni, Telesio's 'disciple' (19). But understanding does not imply total approval. Bacon represented Telesio's theory as superior to the radical moisture doctrine, yet did so with the object of setting rival authorities by the ears. However useful the Telesian theory was as a counter-weight to the received tradition, and however fervently Bacon believed that Telesio had surpassed other philosophers, Telesio's theory was wrong. The radical moisture theorists alleged that heat waned with age; Telesio claimed that it increased; but Bacon combined the two views: heat increased during infancy and maturity, and diminished thereafter. So the Italian philosopher had at least set out in the right direction. Yet, if he was right about the initial *crescendo*, he failed to notice the subsequent *diminuendo*, and (as the *De viis* has it) mistook 'a segment of a circle for the circle itself' (fol.2v).

Turning now to the problematic argument mentioned earlier, Bacon rounded off his attack on the radical moisture theory with an obscure piece of quantitative reasoning concerning the relationship between radical moisture and semen (fol.2r). It has been seen that Avicenna thought that an individual was endowed with a fixed quantity of moisture, and that the moisture originated from the parental semen in a manner unspecified. This issue was taken up and explored by Arnaldus de Villanova whose work, though not mentioned in the *De viis*, was known to Bacon. Put baldly, Arnaldus claimed that if an organism contained no more radical moisture than was present in the semen which generated it, then the original allotment of moisture simply could not be spread thinly enough to sustain the increasingly large body of a growing organism. Consequently, he argued that the fixed quantity of radical moisture had to be supplemented as a *principium essendi* by a *humidum nutrimentale* formed from aliment in each of the bodily members (20).

Bacon, on the contrary, saw no necessity for believing that the original quantum of radical moisture needed to be supplemented as the body grew. The divisibility of matter is such that the original quantum could be effectively spread throughout an animal's body however much it grew. At this point, however, the argument becomes difficult to follow. Bacon adds that no matter how thinly the radical moisture might be spread within the tissues, an animal could still generate enough semen for a lifetime's sexual activity and, since any portion

of semen could produce a new creature, that creature would possess as much radical moisture as its parent. Nevertheless, Bacon concludes that all this reasoning is worthless. One might argue that the radical moisture originates from semen, but not that semen itself originates '*a reliquiis seminis prioris*', i.e. from remnants of the semen derived from an earlier generation. Quantitative considerations compel one to suppose that semen is not derived from such remnants but from the body as a whole.

Bacon seems to be advancing a pangenetic argument to undermine what he takes to be the false, non-pangenetic basis of the radical moisture theory. He seems to assume that the theory depends on the idea that semen of one generation supplies the moisture necessary for creating semen in the next, and that that idea is a quantitative absurdity. He also seems to be trying to trap his opponents in the absurdity by ruling out supplementation theories of the Villanovan variety. But his argument is opaque - perhaps because it is allusive. If that is the case, then sources representing his opponents' complete case (especially in regard to the semen-moisture relationship) have yet to be found.

Bacon's criticisms of earlier writers should not lead one to the automatic assumption that his own work on the prolongation was entirely original. Historians disagree about the nature and extent of his intellectual debts. For instance, Hall has implied that Bacon's theory of ageing represents a total rejection of Arabo-Latin orthodoxy, but Gruman has argued that Bacon's views were 'largely derivative', and that he merely replaced the concepts of radical moisture and innate heat with 'a *similar* concept, that of "spirits"'(21).

Now Bacon certainly departed from the Arabo-Latin consensus in his belief that the processes of ageing only took hold after the onset of adulthood. He believed that while a living being was still growing, its fabric would be entirely repaired and its parts would be 'increased in quantity and bettered in quality' (22). Yet for him, as for Avicenna, Arnold, or Fernel, ageing was essentially a process of progressive desiccation which overtook 'the drier or more porous parts, as the membranes, tunicles, nerves, arteries, veins, bones, cartilages, [and] most of the bowels'. The drying out of these less reparable parts causes the more reparable to fail (23). Gradual loss of moisture (*humor*) from the tissues is accompanied by loss of structural coherence which eventually leads the body to crumble to dust (24).

It would not be unfair to regard the unspecified juices and moistures of which Bacon speaks as something like the glutinous principle of continuity, the radical moisture of Arabo-Latin tradition. Indeed, in the *Historia vitae et mortis* we are advised that the tissues must be made 'roscid *(roscidus)*', and endowed with

'a dewiness diffused (*rore perfuso*) or (if you will) radical (*radicali*)' (25). Again, in the *Historia densi et rari*, we are told to look out for 'menstruums of special juices' which might offer 'the possibility of refreshing and nourishing from without the most radical humours of things (*rerum humores maxime radicales*)' (26). Thus, while denying the utility of theories depending on the diminution of innate heat and radical moisture, Bacon was evidently given to falling back on traditional language and thought - age desiccates, 'bodies in the highest state of heat decline to dryness, and coldness follows after' (27), ageing can be retarded by restoring the bodily moistures, the dewy or radical humours of the tissues. The shadows of Avicennan tradition lurk in Bacon's mind as, for that matter, do the propositions of Telesio. For, whatever limitations he attributed to Telesio's views, Bacon was quite ready, as *part* of his programme for prolonging life, to act on them. According, for instance, to the *Historia vitae* the liver must be kept soft and fat, and prevented from becoming salty and parched (28).

These concessions to Arabo-Latin and Telesian ideas suggest determination to leave no stone unturned in the search for means to prolong life. They suggest a kind of practical, bet-hedging eclecticism coupled with a suspicion of intellectual 'slippage' not unusual in a man struggling to escape from received ideas. But they do not imply anything like total relapse into earlier modes of thought. Bacon sometimes speaks of ageing in terms of the desiccation of dewy or radical moisture but emphatically did not see ageing as consumption of radical moisture by innate heat. As we know, he thought that the body should be viewed 'first as a body inanimate and unsupported by aliment; and secondly as a body animate and nourished; for the first consideration gives laws touching consumption, the second laws touching repair' (29). This 'double-track' approach owes nothing to the traditions of Bacon's age. Moreover, the principal agents of 'consumption', the inanimate spirits, are nothing like the Arabo-Latin innate heat. They prey not just on the juices of living bodies but on all tangible matter; they are not hot; and they cannot be regarded as the principle of life.

It should be granted of course that Bacon's vital spirit resembles the innate heat of Avicennan tradition to the extent that it is both warm and the essence of life. Nevertheless, its intellectual genealogy reaches back through Telesio and Doni (30) to the Galenic concept of cerebro-spinal spirit, and that spirit did not figure in Galenic or post-Galenic theories of ageing and death. Likewise Bacon's theory of inanimate spirit has affinities not with anything in the Avicennan tradition but rather with Neo-platonic, Paracelsian, and late sixteenth-century pneumatism. The theory has affinities with, in other words, concepts of *spiritus* whose importance for Renaissance natural philosophy has been so admirably indicated by Walker, Pagel, Debus, and Hannaway (31).

All the same, source-hunting, however valuable, has its limits. Bacon's ideas about animate and inanimate spirits do not stand alone. They belong to a theory of matter which, whatever the intellectual antecedents of its parts, was unique to him; and as we have seen, that theory was in the process of consolidation as he revised Part B of the *De viis*. No matter what the specific affinities or 'debts', the geography or disposition of concepts within Bacon's system is not, taken in sum, Galenic, Paracelsian, Telesian or anything else. The concepts of vital and inanimate spirit are limited or delimited by adjacent concepts within the overall theory of matter which was itself a systematisation and transformation of borrowings of an initially eclectic character. The view that Bacon was an 'unoriginal' philosopher perhaps arises from an unfortunate tendency to examine particular ideas of his without locating them in their wider context. To understand the concepts of vital and inanimate spirit it is not enough to understand their relationships with putative sources; one must also try to understand why Bacon thought it natural or rational to pattern or associate concepts in the way that he did.

(b) The manuscript: its place in Bacon's work

In form and substance, the *De viis mortis* is a most unusual document. Among extant Bacon texts it is the only one that sheds light, for example, on the origin of vital spirit, states explicitly that the intermediates salt and vital spirit are analogous, and describes the pulsating attack of inanimate spirit on tangible matter (32). But above all the manuscript is unique in that it marks the first appearance of a number of important concepts, and of the links between them. These concepts and links were to become absolutely crucial to the thinking that went into works of Bacon's last years.

The Hardwick manuscript was the first text in which the doctrine of inanimate spirit was systematically applied to the problems of ageing in particular, and terrestrial mutability generally. The manuscript contains the first account of detailed interactions between inanimate spirit and tangible matter, and the first account of the *actio triplex*. As Bacon revised and extended the amanuensis' draft, he linked the *actio triplex* to the earliest surviving statements of the trichotomy of spirits - a trichotomy which was to become the framework for ordering and explaining most terrestrial phenomena, living and non-living (33). Through the trichotomy he introduced the concept of vital spirit, a concept unknown to the amanuensis' draft or to any of Bacon's earlier works. The revision of the Part A draft was also marked by an attempt to integrate ideas about the relationships between intermediates with the doctrine of the two quaternions and, through the two introductory aphorisms presented in Part B (34), with the most general and

fundamental propositions of the emerging matter theory. In addition, Part B is the place where Bacon took the first steps towards the creation of the idea complex, the exhaustive summary of schematisms and motions, that later formed the core of the *Abecedarium novum naturae* (35).

These strivings had untoward (not to say catastrophic) formal consequences. Among Bacon's extant texts, the *De viis* must surely run off with the prize for literary deformity, though the deformity reflects the struggle to achieve an integrated theoretical framework capable, in principle, of explaining all natural phenomena. As has been said, the revision and expansion of Part A could be regarded as the point at which the speculative philosophy really began to coalesce as a system. The work is not just a single snapshot of one stage in the growth of a body of ideas but several snapshots of successive stages. The intricate revisions, changes of plan, and redraftings testify to the rapid elaboration and consolidation of the speculative system. The *De viis* marks not so much a seminal phase in the system's development as a period of rapid maturation; not so much conception as a critical phase of gestation which carried Bacon far towards the fully elaborated positions adopted in the works of the *Instauratio magna*. But, as far as the *De viis* is concerned, intellectual gestation resulted in literary abortion. The eruptive growth of the system simply burst the literary mould in which Bacon had originally intended to cast the work; growth posed organisational problems which he failed to solve within the context of the manuscript.

So Bacon had to begin again, and eventually he produced (among other things) the *Historia vitae et mortis*. Nevertheless it would be misleading to suppose that the *De viis* was, in any direct sense, a sketch towards or precursor of the natural history. Of course both texts deal with the prolongation of life, and a glance at the general notes to the transcription of the manuscript will show that much of the doctrine and, indeed, the very phraseology of the *De viis* were incorporated wholesale into the *Historia*. However, the two works are very different. The *Historia vitae*, perhaps the finest and most influential of Bacon's single-subject natural histories, is easy to locate within the context of his output. Even before the work was published Bacon had said what it was meant to be, what it was meant to do, and where it was meant to stand. It was to belong to the third part of the *Instauratio magna*, to a literary structure far greater than itself. It was meant to illustrate, albeit imperfectly, the requirements of its author's natural-historical programme as well as to deliver theoretical and practical directions for prolonging life (36). About three quarters of the work is devoted to carefully arranged tables of data, and much of the text deals with matters never even alluded to in the *De viis* (37).

The scope and purpose of the two works overlap but are far from being identical. The *De viis* is not and was never meant to be a natural

history, though it might have had more data in it - had Bacon taken the work further (38). Moreover, the *De viis* was not written as part of the *Instauratio*. After it had got out of hand and broken down, Bacon seems to have cannibalised the *De viis* when he came to write the *Historia vitae*, but the latter was produced under the pressure of constraints and plans quite different from those that had informed the earlier work. The *De viis* has a name but (unlike the history) no obvious local habitation. No other Bacon work tells us why the *De viis* was written or about its relationship (if any) with his other texts (39). In the absence of helpful evidence of that kind, it is worth recalling evidence presented at the beginning of this study - that the amanuensis' draft was written c1612 and revised, expanded, and abandoned before c1619, and that the text was once preceded by a complete copy of the *De fluxu et refluxu maris* drafted by the same amanuensis (40).

It seems likely that the amanuensis had been directed to produce fair copies of the *De fluxu* (c1611) and *De viis* so that both works could be printed or circulated in manuscript together as a single volume. Perhaps these were to be accompanied by fair copies of the *Phaenomena universi* (c1611) and *Thema coeli* (1612), the other speculative essays of this period (41), so that all the fruits of Bacon's intense preoccupation with speculative matters at this point in his career could see the light of day. If Bacon planned to publish a set of two or more of these essays, then the plan came to nothing. Perhaps it had been rendered obsolete by the same rapid maturing and consolidation of the speculative system that had compelled Bacon to revise, and then abandon the *De viis*.

At all events, after abandoning the *De viis*, he never again set his hand to the production of a speculative essay. That phase of his career was over. He turned instead to planning, writing, and publishing the works of the *Instauratio magna*, the ambitious multi-volume sequence, the dual purpose *summa* designed to serve as a vehicle for the method and programme, and for the speculative philosophy (42).

(c) The speculative philosophy and the method

The *De viis mortis* is not important only for what it can tell us about Bacon's biological ideas and the intellectual matrix from which they sprang, the growth and growing together of elements of the speculative philosophy and, more generally, his thinking after c1612 and before c1619. It is also important quite simply because it is concerned with aspects of the speculative philosophy and not with the ideas on which his reputation later rested. In fact, the Hardwick manuscript and the other recently discovered manuscripts testify to Bacon's enthusiasm for the speculative system rather than his

preoccupation with the great issues of the method and programme for recovering man's sovereignty over nature (43).

These manuscripts, taken together with the huge volume of speculative materials in the printed works, cannot but alter the basis of our understanding of what Bacon was about. They may also help in the business of clearing away the worn-out machinery of traditional Bacon scholarship. No definitive reconstruction of his thought is going to be erected on the assumption that the *Novum organum* or, indeed, the method as a whole truly or fully represents the totality of his endeavour. It is unlikely that a satisfactory reconstruction can be raised without some recognition of the virtual parity of the method and speculative philosophy in terms of the effort that Bacon devoted to them.

That recognition might lead one to ask why Bacon put so much work into an enterprise which apparently violated his most fundamental methodological principles, to ask why he immersed himself in two seemingly contradictory pursuits. How could he piece together a speculative system which seems to embody the very idols, the very intellectual vices that his method was designed to circumvent? But perhaps these questions do not bear the right emphasis. Perhaps it is the existence of the method, not the speculative philosophy, that needs explaining. Putting it in an extreme form, one might ask why Bacon bothered to write the *Novum organum* when he already possessed what he saw as a worthwhile body of substantive natural philosophy.

Up to a point the answer to this question is quite straightforward and turns on the status accorded to the propositions of the speculative philosophy. Did Bacon think that these propositions were true, false, or probable? Now he cannot have regarded them as indubitably true or he would have had no need to construct the method and programme. If he thought them false then why on earth would he have spent so much time elaborating them? It would seem then that he must have regarded them as persuasive but by no means certain (44). In fact Bacon captured his view of their status in a couple of rather telling images. According to one, his theories 'will serve in the meantime for wayside inns, in which the mind may rest and refresh itself on its journey to more certain conclusions' (45). The speculative philosophy will fortify and inspire travellers on the hard road leading to the accomplishment of the inductive philosophy. But, more than that, the speculative philosophy would actually lie beside the road. It too would tend towards natural-philosophical truth though not as surely and inevitably as a science based on 'legitimate' procedures (46). The second image embodies stronger claims. The speculative philosophy is like 'interest payable from time to time until the principal be forthcoming' for, Bacon adds, 'I do not make so blindly for the end of my journey as to neglect anything which may turn up by the way' (47). Interest is, of course, as bankable as the

principal itself; the speculative philosophy might yield results as good, though not as plentiful, as those promised by the true, inductive philosophy.

Bacon used these images when writing about his plans for Part Five of the six-part *Instauratio magna*. In Part Five he intended to draw together speculative materials secreted in other works of the *Instauratio* and fashion them into a coherent account of the system (48). Part Six was reserved for the fruits of the new method. But in an early plan of the *Instauratio* he actually expressed the hope that '*ex usu rationis legitimo verificari*', some of the content of Part Five might be promoted into Part Six (49). The speculative philosophy is therefore a provisional system, something to be going on with; it is also a vision of the kind of science that Bacon thought the inductive method might produce; it is even a temporary vehicle for truths which, in the course of time, would be confirmed by the new method. He could scarcely have lavished such care on the speculative philosophy unless he had believed something like that, and it is difficult to imagine him writing and painstakingly revising the *De viis*, then abandoning it and composing the much more extensive *Historia vitae et mortis*, unless he had had a great deal of faith in the propositions they advanced.

This interpretation of Bacon's position simultaneously explains his devotion to the speculative philosophy and the fact that he was able to pursue with equal doggedness his two apparently contadictory philosophical enterprises. But that is not quite the end of the story. The interpretation outlined above solves some problems but it creates others. It seems to work adequately for all save the earliest years of his philosophical career. The view of the speculative philosophy as interest on capital invested in promoting the method and programme may have been one that he arrived at but did not start from. On the very scanty evidence available it seems that the speculative system may have begun to take shape before the methodological proposals; certainly there is no shred of evidence that the latter preceded the former.

In about 1592, his thirtieth year, Bacon wrote a court entertainment which contains this passage:

> We would not smile at Aristotle, when he admireth the eternity and invariableness of the heavens, as there were not the like in the bowels of the earth? Those be the confines and borders of these two kingdoms, where continual alteration and incursion are. The superfices and upper parts of the earth are full of varieties. The superfices and lower parts of the heavens (which we call the middle region of the air) is full of variety. There is much spirit in the one part that cannot be refined into spirit. the common air is as the waste ground between the borders. Who would

> not smile at the astronomers, I mean not these new carmen which drive the earth about, but the ancient astronomers, which feign the moon to be the swiftest of the planets in motion, and the rest in order the higher the slower; and so are compelled to imagine a double motion; whereas how evident it is, that that which they call a contrary motion is but an abatement of motion. The fixed stars overgo Saturn, and so in them and the rest all is but one motion, and the nearer the earth the slower; a motion also whereof air and water do participate though much interrupted ... (50).

This is nothing less than an outline of some of the main speculative doctrines expressed in the language of total conviction. There is absolutely nothing provisional about it. No such account of his methodological proposals survives from this early date (51). Indeed it is possible that the emergent speculative philosophy played midwife to the method. Having convinced himself that the doctrines presented in the entertainment were correct, he may have wondered how he might work others into the same conviction, how he could persuade contemporaries that his embryonic system was better than the offerings of the Paracelsians, Telesians, and a host of other contending sects. Such questions may have caused him to think about methodological issues. If that were the case, then the method originated perhaps from an attempt to identify common weaknesses of rival systems, and to erect criteria for assessing their epistemological merits. That, in turn, may have sparked off the development of the method and programme, and in consequence caused him to adopt a more cautious, provisional tone when writing about aspects of the speculative system. It may also have engendered a dialectical relationship between his two philosophies whereby each continued to exercise some influence on the shaping of the other (52).

There is then a possibility that the celebrated method and programme were by-products of early speculative enthusiasms, and that the philosophy that made Bacon's name so influential in the seventeenth century emerged almost by accident from questions arising from a body of knowledge, later represented in the *De viis mortis*, unknown to Bacon's successors. But conjecture is no substitute for solid study. We need to know more about Bacon's formative years, the intellectual *milieux* he inhabited at Cambridge, in France, and at Gray's Inn. We need to know more about his reading and Continental contacts. We need to pay close attention to the documents which he produced before 1600. The roots of Bacon's achievement lie buried in the soil of the late sixteenth century. Unless they can be exposed more fully, some of the outstanding questions about his intellectual history will remain unanswered.

Notes to Chapter 5

1 See "Works", III, 340: 'this proficience in navigation and discoveries may plant also an expectation of the further proficience and augmentation of all sciences; because it may seem they are ordained by God to be coevals, that is, to meet in one age. For so the prophet Daniel speaking of the latter times foretelleth, *Plurimi pertransibunt, et multiplex erit scientia*: as if the openness and through passage of the world and the increase of knowledge were appointed to be in the same ages ...' For similar statements see ibid., I, 200, 514. The Daniel prophecy appears in the frontispiece of the *Instauratio magna*, ibid., I, 119. For a recent survey of relationships between prophecy and science in the sixteenth and seventeenth centuries see C. Webster, "From Paracelsus to Newton: magic and the making of modern science", Cambridge, 1982, pp.1-42.

2 "Works", III, 222.

3 Ibid., III, 167-8. Bacon lists some thirty-three '*Magnalia naturae, praecipue quoad usus humanos*'. The first three items in the list are the prolongation of life, the restitution of youth 'in some degree', and the retardation of age.

4 In this respect Bacon's view is very similar to that of Roger Bacon; see E. Brehm, 'Roger Bacon's place in the history of alchemy', Ambix, 1976, xxiii, 53-8 (56).

5 "Works", I, 598.

6 Ibid., II, 114, 147, 158-9, 174, 199, III, 531-6.

7 See W. Pagel, "William Harvey's biological ideas", Basel, 1967, pp.257-8; T. S. Hall, 'Life, death and the radical moisture; a study of thematic pattern in medieval medical theory', Clio Medica, 1971, vi, 3-33 (4-8).

8 M. McVaugh, 'The *"humidum radicale"* in thirteenth-century medicine', Traditio, 1974, xxx, 259-83 (259-65).

9 See Hall, op. cit. (7), p.8; T. C. Theoharides, 'Galen on marasmus', J. Hist. Med., 1971, xxvi, 369-90.

10 *"Liber canonis"*, Venice, 1507; reprinted Hildesheim, 1964, lib. I, fen 1, doct. 4. The first of the secondary humours '*est humor in foraminibus extremitatum parvarum venarum contentus membris simplicibus propinquarum inbibentium eam*'; the second is '*humor per omnia transiens membra, sicut ros qui in nutrimentum converti est aptus cum corpus nutrimento caret, et ut membra humectet cum aliqua causa fortis motus aut alia ea exiccaverit*'. Also see McVaugh, op. cit. (8), pp.265-6.

11 *"Liber canonis"*, op. cit.(10). The third secondary humour or *cambium 'est humor qui parum ante congelatus fuit, et est nutrimentum quod in substantia membrorum ex parte complexionis conversum est. Sed ex parte essentie complete et similitudinis nondum conversum fuit'*; the fourth humour or *gluten 'est humor qui est intus in membris simplicibus a principio nativitatis per quem partium eorum continuitas existit ...'*

12 *"Liber canonis"*, op. cit. (10), and lib. IV, fen 1, tract. 3, cap. 1.

Also see McVaugh, op. cit. (8), p.266; Hall, op. cit. (7), pp.7-8; P. H. Niebyl, 'Old age, fever, and the lamp metaphor', J. Hist. Med., 1971, xxvi, 351-68 (359). For Aristotle's views on *calor innatus* see W. D. Ross & J. A. Smith (eds.), "The works of Aristotle, translated into English", 12 vols., Oxford, 1908-1952, III, 468b, 474b, 478b.

13 *"Liber canonis"*, op. cit.(10), lib. I, fen 3, doct. 3; lib. IV, fen 1, tract. 3. Also see Niebyl, op. cit. (12), pp.358-9.

14 *"Liber canonis"*, op. cit.(10), lib. I, fen 1, doct. 3, cap. 3; McVaugh, op. cit. (8), pp.267-8; Hall, op. cit. (7), p.5.

15 McVaugh, op. cit. (8), pp.269-77; for Joubert (1529-1583) and a translation of his work on this topic see F. M. Gale, '"Whether it is possible to prolong man's life through the use of medicine"', J. Hist. Med., 1971, xxvi, 391-9.

16 The *Historia vitae et mortis* was very popular in the seventeenth century both in the Latin original and in two English translations; see Rees, op. cit. (ch. 1, 1), pp.378 note 9, 387 note 54. The possibility that Bacon's work contributed to the decline of the radical moisture theory clearly exists, though I have not come across any seventeenth-century text which cites Bacon as an authority against the theory.

17 See explanatory notes to the transcription, note 2.

18 L. de Franco (ed.), *"Bernardini Telesii de rerum natura"*, Cosenza, 1974, II, 540-53; see especially the passage quoted in the explanatory notes to the transcription, note 3. For a useful if somewhat outdated account of Telesio's view of living beings see E. Zavattari, *"La visione della vita nel rinascimento e Bernardino Telesio"*, Torino, 1923, esp. pp.264-7.

19 For Doni's theories see L. de Franco, op. cit. (ch. 3, 52), pp.358-62. A useful account of Bacon's knowledge of Telesio is provided by V. G. Assenza, *'Bernardino Telesio: il migliore dei moderni. I riferimenti a Telesio negli scritti di Francesco Bacone'*, *Rivista critica di storia della filosofia*, 1980, xxxv, 41-79.

20 *"Arnaldi Villanovani philosophi et medici summi opera omnia"*, Basileae: Conradum Waldkirch, 1585, pp.294-319; McVaugh, op. cit. (8), pp.277-81.

21 Hall, op. cit (7), p.15; G. J. Gruman, "A history of ideas about the prolongation of life: the evolution of prolongevity hypotheses to 1800", Trans. Am. Phil. Soc., new series, Vol. LVI, pt. 9, 1966, p.82. The emphasis in the quotation is mine.

22 "Works", II, 106, cf. fol.21r.

23 Loc. cit.

24 "Works", II, 121, cf. fol.4v.

25 "Works", II, 184.

26 Ibid., II, 281.

27 Ibid., II, 211.

28 Ibid., II, 189; 210.

29 Ibid., II, 214.

30 In this connexion, it is to be hoped that someone will produce a detailed study of Bacon's responses to Telesio and Doni. It is possible

that much remains to be learnt about these, and especially about the relationship between the ideas of Doni and Bacon. The foundations for such a study have already been laid by Assenza, op. cit. (19), pp.41-67, and by D. P. Walker, "Spiritual and demonic magic from Ficino to Campanella", Liechtenstein, 1969.

31 Ibid.; idem, 'Francis Bacon and *spiritus*', in A. G. Debus (ed.), "Science, medicine and society in the Renaissance", 2 vols., London, 1972, II, 121-30; W. Pagel, "Paracelsus: an introduction to philosophical medicine in the era of the Renaissance", Basel, 1958; idem, 'Paracelsus and the neoplatonic and gnostic tradition', Ambix, 1960, viii, 125-66; 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, 1975.

32 See chs. 3-4.

33 See ch. 3, sect. b; ch. 4, sect. b.

34 See fols.22r, 25r, 26r.

35 See ch. 4, sect. d.

36 Bacon knew very well that his model natural histories had deficiencies in the scope and quality of data presented - deficiencies which, he believed, would only be made good by cooperative endeavour; see "Works", II, 13-18.

37 See e.g., ibid., II, 157-75, 180-203.

38 See explanatory notes to the transcription, note 37.

39 Bacon quite often referred to earlier works in later ones; and of course all the works of the *Instauratio* can be related to each other via the plan of the six-part sequence.

40 See ch. 1, sect. a.

41 In the *Thema* Bacon actually mentions the *De fluxu* in such a way as to suggest that the reader would already have read the latter; see "Works", III, 776.

42 For the place of the speculative philosophy in the *Instauratio magna* see Rees, op. cit. (Ch. 2, 6).

43 The other manuscripts listed in ch. 1, note 1.

44 Evidence for this conclusion is presented in Rees, op. cit. (ch. 2, 20), pp.118-21.

45 "Works", I, 144.

46 The 'legitimate' procedures are of course those embodied in Bacon's method.

47 "Works", I, 143-4.

48 See Rees, op. cit. (ch. 2, 6), pp.172-3.

49 "Works", III, 547.

50 Spedding, op. cit. (ch. 1, 11), I, 124-5, cf. idem, op. cit. (ch. 2, 5), p.14.

51 In a letter to Burghley written at about the same time as the court entertainment, Bacon declared that he wished to purge the province of knowledge of 'two sorts of rovers' - the alchemists and the scholastics. In place of their learning, he wished to 'bring in industrious observations, grounded conclusions, and profitable inventions and discoveries' (Spedding, op. cit. (ch. 1, 11), I, 108-9). Here, as

in the court entertainment (ibid., I, 125-6), Bacon seems to set up utility as the end of knowledge, but says nothing about natural history, induction, cooperative research or any of the other proposals which were to become essential to his method and programme. If he had already worked out the main features of the method and programme by 1592, why did he not mention them in the court entertainment, why did he choose instead to declare his speculative allegiances?

52 For instance, Bacon's efforts from 1620 onwards to assemble quantities of experimental and observational data in support of the speculative system were no doubt prompted by his methodological ideals. Conversely, the titles of the natural histories which Bacon wrote to illustrate the requirements of Part Three of the *Instauratio* were chosen under the influence of his speculative preoccupations; see Rees, op. cit. (ch. 2, 6), 168-71.

DE VIIS MORTIS

THE TRANSCRIPTION AND TRANSLATION

General principles of transcription and translation

The order of items in manuscript Hardwick 72A has been retained in the transcription. No attempt has been made to reshuffle the contents in accordance with conjectures (ch. 1, sect. b) relating to Bacon's changing ideas about the disposition of his materials. Editorial reshuffling would have destroyed, impaired, or obscured evidence crucial to an understanding of the internal history of the manuscript, the growth of Bacon's ideas, and other important matters.

The following symbols have been used in the transcription:
Square brackets ([]) enclose deletions.
Diamond brackets (<>) frame marginalia, interlinear interpolations, and other added materials intended for incorporation in the body of the text proper.
Slashes (//) enclose endorsements, marks, etc. which do not belong to the body of the text. Slashes enclosed in diamond brackets indicate endorsements etc. added during revision.
Three stops (...) indicate illegible words for which no conjectural reading can be supplied.

In the interests of clarity the orthography has been modernised, modern paragraphing introduced, and scribal contractions expanded. The manuscript is so heavily encumbered with revisions that the wish to provide a full and faithful transcription conflicts with the desire to provide a clean and readable text. Up to a point, the conflict has been resolved by consigning a host of minor deletions to the textual footnotes. These footnotes preserve every deletion, and record their exact positions in the manuscript (see remarks preceding the textual footnotes). Only in the case of certain Part B drafts (fols.25r, 28r, and the first paragraph of fol.29v) which were subsequently redrafted elsewhere (fols.22r, 29r, and the last two paragraphs of fol.29v) have all the deletions been retained in the body of the transcription - to give some impression of the appearance of the more heavily revised sections of the manuscript. The textual footnotes, related to the transcription by page and line numbers, also indicate conjectural readings, editorial corrections and emendations, and the significance of various marks and endorsements.

The transcription is also supported by general notes. These have been indicated in the usual way - by consecutive reference numbers in the text. They indicate parallels in Bacon's other writings, give

sources of literary allusions, explain doctrines, and so forth.

The Latin text poses unusual difficulties for the translator - especially where Bacon himself revised or drafted it. His minor deletions occasionally appear to reverse the intended sense of a sentence or paragraph; his habit of incremental revision spawned afterthoughts and interpolated subordinate clauses by the score. For these and related reasons, a few passages in the translation read more awkwardly than we would wish; and where necessary, we have not hesitated to sacrifice elegance for the sake of accuracy, and literal translation for the sake of sense.

Where deletions have been retained in the body of the transcription, they have been translated; deleted incomplete words have been translated in cases where one can make reliable guesses about what Bacon intended to write. Mere slips of the pen have not been carried over into the translation; nor have certain marks and endorsements which appear in the Latin text but which would add nothing to the translation. Footnotes to the translation have been kept to a minimum.

MANUSCRIPT HARDWICK 72A
PART A
(Amanuensis' draft with Bacon's autograph revisions)

(fol.1v)

De viis mortis, et de senectute retardanda, atque instaurandis viribus

Quod ali perpetuo potest, et alendo restitui in integrum, id potentia aeternum est tanquam ignis vestalis. Itaque vulgus philosophantium et medicorum mortem quaesiverunt in aliquo quod vere ali non possit sed refici tantum per appositionem degenerem quae, sensim declinans, pravum deducat ad nullum. Neque enim viderunt quo modo animal vergere possit ad interitum nisi aliquid in animale veterascat; hoc est maneat, et manendo depravetur (1).

Itaque excogitarunt commentum illud humoris radicalis et primigenii <qui>, quanto ipso parvus, viribus ingens, nunquam restituatur vere sed a prima infantia decrescat, et cuius consumptio et exinanitio sit mensura vitae. Addiderunt et simile commentum de calore naturali tanquam primordium activum qui per infantiam similiter sit in summo vigore, deinde paulatim debilitetur et extinguatur. Humores vero qui in corporibus animalium conspicui sunt, et calores qui percipiuntur, habita ratione ad humorem et calorem primigenium, existimarunt res ascititias esse, et imitamenta mole longe illos alteros superantia, virtute et potestate nullo modo illis exaequata (2).

Ex altera parte, atque adeo ex opposito, Telesius mortem quaesivit non in decremento (fol.2r) aliquo, sed in excessa; opinatus calorem cum aetate perpetuo magis et magis ignescere et acriorem fieri, praesertim in hepate quae in animalibus tenerae aetatis invenitur albicans, mollis, sapore dulcis vel suppinguis; in senili vero corpore nigricans, durus, salsus, et quasi torrefactus. Itaque cum sanguis sit corporis verus succus et irrigatio, sanguinis vero natura sequatur jecur, ex ista adustione jecinoris plane corpus destrui putavit (3).

MANUSCRIPT HARDWICK 72A
PART A
(Amanuensis' draft with Bacon's autograph revisions)

(fol.1v)

An inquiry concerning the ways of death, the postponing of old age, and restoration of the vital powers

Anything that can be constantly fed and completely restored by feeding is, like the vestal fire, potentially eternal. Thus run-of-the-mill philosophers and physicians have looked for death in something that could not be fed properly but could only be renewed through imperfect augmentation which, gradually declining, would reduce a bad state to nothing at all. Moreover, they have not understood how an animal could approach death unless something within it grew older; unless, in other words, something lasted and by lasting became corrupted.

Therefore they thought up that fiction of the radical and primigenial (1) moisture <which>, small in quantity alone but prodigious in power, is never restored truly but decreases from earliest infancy, and is in its consumption and exhaustion the measure of life. And they added the similar fiction about natural heat as a primary active principle which is similarly at the height of its power during infancy but is gradually weakened and extinguished thereafter. Indeed they imagined that the moistures and heats which can be detected in the bodies of animals are, compared to the primigenial moisture and heat, mere shadows or adventitious things which surpass the primigenial moisture and heat in point of mass but by no means in power and virtue.

On the other hand, and indeed in opposition, Telesio did not seek the cause of death in any kind of wasting away. (fol.2r) Instead, he looked for it in superfluity, supposing that with age the heat of the body became increasingly inflamed and sharp - especially in the liver which is seen to be white, soft, and rich or sweet to the taste in young animals but, in an aged body, blackened, hard, salty, and just as if it were parched. Thus, since blood is the true sap and refreshment of the body, and since the nature of the blood certainly depends upon the liver, he thought it plain that the body was overthrown by this same parching of the liver.

Atque hae opiniones et commentationes sunt hominum qui ex natura pauca arripiunt, reliqua affingunt. Nam quod humor aliquis in corpore esse possit qui, in tanta molis differentia quanta sit inter pusillum infantem et adultum in statu, dilatetur tantummodo sed non augeatur, durum omnino videatur; sed tamen ob divisibilem admodum rerum naturam non prorsus incredibile censeri possit. Ut vero eadem massa sive moles cum humore illo in minimas portiones diffuso et diviso sufficere possit generando tanto semini quantum ab animalibus adultis utriusque sexus diffundi et dispergi ad prolificationem per omnem aetatem suam possit, utque quaevis portio illius seminis novum animal gignere possit quod tantundem habeat humoris radicalis quantum primum animal habuerit, hocque per infinitas successiones derivetur (4).

Incommodum evidentissimum; humor enim ille radicalis a nulla alia re quam a semine; at semen ipsum a massa corporis, non a reliquiis seminis prioris - ut ex rationibus quanti ipsius manifestum est. [Idque acutiores ex medicis perspexerunt et agnoverunt.] <[ut ista opinio, licet apud novitios valida, tamen prudentioribus minus molesta sit]> (5). (fol.2v) Rursus quod sit calor aliquis, sive naturalis sive quocunque is nomine vocetur, maior in infante quam in juvene et viro, cum et tactu, et motu, et concoctione, et omnibus functionibus et signis, calor virilis calorem puerilem longe excedere reperiatur, res fictitia est neque commode etiam ficta, quae in tot sensus ipsius reprehensiones incurrat (6). <Ex quo fit ut istae opiniones, licet apud <turbam medicorum> validae, tamen prudentioribus ex medicis minus molestae sint>.

At illa sententia Telesii magis citra veritatem cadit quam a veritate aberrat, <siquidem> alienum a vero <non> est calorem cum aetate intendi et insurgere in calorem magis acrem et igneum quique alimenta sua magis absorbeat et depascat; sed abrumpit contemplationem Telesius, [et quasi sectionem circuli accipit pro circulo. Eadem] <neque eam producit ut par est. Neque> enim acrimonia <illa> caloris invalescense <ita coetera destruit ut ipse nihilominus perpetuo augeatur sed> eo rem deducit ut in decursu aetatis ille <ipse> calor <[quasi] sit retrogradus, et loco augmenti minuatur plane>, et sensim deficiat ut ex tarditate motus,

But those others (2) are the speculations and fancies of men who take a few things from nature but invent the rest. For it seems altogether implausible that any humour which may only spread out but not grow in quantity could exist in a body in as great a diversity of mass as may be between a tiny child and an adult in point of size. But nevertheless, on account of the exceedingly divisible nature of things, it cannot be deemed wholly incredible. In fact, as the same mass or bulk, with that humour diffused and divided into the smallest portions, could suffice for generating as much semen as could be scattered and spent by grown animals of either sex for reproduction in their entire lives, and as any portion of that semen whatever could generate a new animal, that animal would have just as much of the radical moisture as the first animal had, and this would go on from generation to generation without end.

The weakness of this argument is glaring; for the radical moisture comes from nothing other than the semen, but the semen itself comes from the mass of the body, not from remnants of earlier seed - as is obvious from a reckoning of its quantity. [And this has been recognised and acknowledged by the more judicious of the physicians] <[so that this view, though influential with novices, is nevertheless not so troublesome to the more sagacious]>. (fol.2v) Again, the idea that any heat, be it called natural or anything else, might be greater in a child than in a youth or a man is an artifice and not a well-contrived one seeing that it runs up against so many objections from the senses, since touch, motion, digestion, and all functions and signs testify that the heat of a man far surpasses that of a boy. <Whence it happens that these opinions, though influential with the vulgar herd of physicians, are nevertheless not so troublesome to the more sagacious among them>.

By contrast, Telesio's theory comes far closer to the truth than it deviates from it <insofar as> it is <not> inconsistent with the fact that heat grows stronger with age, and raises itself to a more sharp and fiery heat which feeds on and exhausts its food more rapidly. But Telesio does not pursue this idea, [and, as it were, mistakes a segment of a circle for the circle itself. The same] <and does not develop it as he should have done>. For the situation is <not> that <the> ferocity of the heat increases and consumes <the rest in such a way that it grows unabated but> that, in the course of time, it reaches a point where the heat <itself> <[as if] is reduced and, instead of growing, clearly decreases> and gradually fails, as is strikingly apparent from the

atque omnium facultatum in senibus, atque ex debilitate concoctionis, et morbis pituitosis, et effoetura, atque etiam ex tactu ipso manifeste deprehenditur (7).

Veritas autem rei ita plane se habet: spiritum ex multiplicatione <et incensione> sui officinam suam perdere in qua ipse reficiatur - ut postea fusius dicetur. Missis igitur huiusmodi levibus contemplationibus, nos inquisitionem istam retractabimus; neque tam facile quam fieri solet, oculos a rerum natura dejiciemus.

Primo igitur ut inquisitio non confundatur, qui exolutionem animalis intueri eiusque causas, atque remedia si quae sunt, aut saltem moras perscrutari conatur, tale initium sumere (fol.3r) debet ut contempletur primum animal tanquam inanimatum, atque inalimentatum; postea vero ac seorsim tanquam animatum et alimentatum. Dubium enim non est <quin> quaecunque patitur corpus naturale inanimatum ut puta lignum, lapis, metallum, planta avulsa, et similia a tempore sive aetate, atque ab aere circumfuso, et radiis coelestium, et tempestatum mutationibus ac vicissitudine, eadem <quoque patiatur> animatum, nisi quod superaddita natura vitalis partim injurias illas temporis atque externorum propulset, partim (quod praecipuum est) easdem per alimentationem reparet et reficiat.

Itaque [triplex] <duplex> oritur inquisitio: prima, ut contemplemur dissolutionem corporis in animale tanquam re mortua et inanimata; secunda, tanquam cum vita <neque id tamen tantummodo> quatenus vita habeatur pro salillo quod putrefactionem arceat tantum, atque etiam injurias illas temporis et externorum nonnihil froenet et arceat, [Tertia] <sed etiam> tanquam animatum simul et alimentatum <quod refici et reparari possit tractando simul> ipsas alimentandi vias atque impedimenta. In illis enim consistit <vel maxime> renovatio animalis aut defectio (8).

Quod ad primam inquisitionem attinet, videmus corpora solida quae non nutriuntur, et quae aetatem ferunt, atque eius vices, nec a putrefactione intercipiuntur, primo tenera, dein dura, postea arida, subinde porosa, rimosa,rugosa,cariosa,

sluggishness of motion and all faculties in old men, from weakness of digestion, phlegmatic complaints, enervation and, indeed, from the sense of touch itself.

However, the truth of the matter is clearly this: that the spirit itself by its multiplication <and inflammation> destroys the very workshop in which the spirit itself is repaired - as will be explained in greater detail later. Thus, leaving aside fanciful speculations of all kinds, we shall ourselves open up this inquiry again, and not take our eyes off the facts of nature as easily as people usually do.

In the first place, so that the inquiry does not become confused, he who tries to examine the dissolution of an animal, its causes and cures (if there are any), or, at least, means of delaying it, ought to begin (fol.3r) by considering the animal first as if it were inanimate and unnourished but then separately as a being animate and nourished. It is certainly true <that> whatever an inanimate natural body - as, for example, wood, stone, metal, uprooted plant, and the like - suffers through time or age, the surrounding air, the rays of the heavenly bodies, and the changes and vicissitudes of climate, these same things are <also endured> by a living body - except that the vital nature superadded may partly repel the injuries of time and external influences, and partly (which is the main thing) repair and restore these same injuries by taking in nourishment.

Thus the inquiry seems to be [threefold] <twofold>: firstly, that we view the dissolution of the animal body as if it were taking place in a dead and lifeless thing; secondly, as occurring in something endowed with life, seeing that it has life for a brief interval which may only inhibit putrefaction and also somewhat mitigate and prevent the injuries inflicted by time and external influences. [Thirdly] <But things do not stop there, for we also view an animal> as something <furthermore> which is living and nourished at the same time <because it can be at once refreshed and repaired by managing> the very ways and obstacles to nutrition. Indeed, the renovation or destruction of an animal consists in these things <most particularly> (3).

As far as the first inquiry is concerned, we see that solid bodies which do not take food, and which suffer ravages of time and its vicissitudes, but are not cut off by putrefaction are at first soft, then hard, and afterwards

rubiginosa, ad extremum putria, et tanquam incinerata - idque subtiliore incineratione quam facit ignis - etiam tandem evanida (fol.3v) atque quasi in aerem abeuntia. Atque universus iste processus nihil aliud est <quam actio triplex, videlicet>: attenuatio; et subinde partis attenuatae evolatio; partis vero manentis et non attenuatae, contractio (9).

Nam quod <non sit simpliciter evolatio sed quod> attenuatio praecedat, id patet ex decremento ponderis siquidem corpus non nutritum ab ipso statim principio decrescit pondere, et similiter continuata serie vertitur in levius ac levius unde manifestum est jacturam fieri substantiae crassioris. Etenim spiritus aut tenue <prius> inclusum tantum abest ut pondus gravet ut nonnulla ex parte levet. Itaque spiritus praeinexistentis evolatio per se nihil deperditura fuisset ponderis. Sed spiritus ille innatus et praeinexistens primo depraedatur aliquid ex substantia crassiore, illudque <confecit, et in spiritum vertit, atque> una secum vehit, eaque simul evolant unde fit diminutio ponderis. Ergo necesse est ut ponatur attenuatio, atque adeo series sive successio attenuationis, prout res gradatim decrescit pondere (10).

Evolatio autem quae secunda actio est in dissolutione omnium evidentissima est, tum ex illa ipsa jactura ponderis, tum ex eo quod corpora redduntur magis cava et resonantia, tum etiam quandoque ex ipsa alteratione superficiei corporis ex plana in asperam et sursum elevatam ubi invenitur quaedam non tam evolatio quam emigratio <quandoquidem in hoc casu> separatio partium <sit> plane visibilis. Etenim in corporibus quae minime sunt porosa sed humida et sequacia, ideoque magis compacta, non invenit spiritus meatus et vias per <quas> occulte evolet, sed plane agit (fol.4r) ante se partes crassas, quas ipse laxavit et confecit, easque ultra planum corporis extrudit ut fit in omni carie atque rubigine metallorum. Etiam secreta illa evolatio quae oculos fallit, prodit se ad olfactum, ut in odoribus; etiam pars illa volatica, si violenter et confertim extrudatur, plane sub aspectum cadit, ut in fumis et vaporibus (11).

At tertia actio in dissolutione quae est contractio partis manentis et non attenuatae, paulo magis obscura nec minus vera est. Manifestatur enim tum ex duritie quae

dry, and presently porous, fissured, wrinkled, rotten, rusted. At last they are corrupted, and as if reduced to ashes (though by a more subtle reduction than fire produces), and finally (fol.3v) they pass away and disappear as it were into air. Now the whole of this process is nothing other <than a threefold operation - namely> attenuation, followed by escape of the attenuated part, and contraction of the unattenuated part left behind.

For the fact <that it is not just a matter of escape but that> attenuation precedes it is obvious from weight loss, inasmuch as an unnourished body steadily loses weight from the very beginning, and likewise continues to turn into something lighter and lighter still, whence it is plain that some diminution of the grosser matter takes place. For the spirit or tenuous substance <formerly> enclosed is far from weighing it down, but considerably lightens it. Thus the escape of the preexisting spirit has by itself in no way reduced the weight. Rather the innate and preexisting spirit plunders something from the grosser matter, <elaborates it, and turns it into spirit>, carries it off with it, and both of them escape together and the weight loss stems from that. It is necessary therefore that attenuation and also its progression and succession be considered as it gradually reduces the weight of an object.

However, escape, the second operation in dissolution, is the plainest of all - as much from the weight loss as from the fact that bodies become more resonant and hollow or, again, as from the very alteration (at a certain point) of the surface of the body from smooth to rough and protruberant, in which case one perceives emigration more than escape <since, in this instance> separation of the parts <is> clearly visible. For in bodies with very few pores but which are moist and pliant, and for that reason more compact, the spirit fails to discover passages or channels through <which> it might secretly escape but visibly pushes (fol.4r) before it the gross parts which it has loosened and worked upon, and squeezes them out above the surface of the body - as happens in all corrosion and rusting of metals. Furthermore, that covert escape which eludes sight manifests itself to the sense of smell, as for example in odours; and the volatile component may also be forced out so violently and compactly that it can easily be seen - as for instance in fumes and vapours.

As for the third operation in dissolution which is the contraction of the unattenuated parts left over, that operation is rather more obscure though no less real. Now

constipationem illam partium sequitur, tum ex rimis quae fiunt interdum ex desiccatione accelerata ubi partes rei se contrahunt tam obstinate ut in aliis partibus continuum evidenter divellant. At multo magis se ostendit actio illa contractionis in reductione aut minutione quae fit secundum totum atque undequaque, quemadmodum invenitur in nucleis nucum qui, veteres cum fuerint, non implent testam ut prius; atque similiter in trabibus et aliis materiis ligneis in domibus aut aliis clausuris quae si ponantur virides, licet bene clausae et aptatae fuerint a principio, tamen non ita multo <post> disjunguntur et hiant <adeo ut in his fiat pura contractio in toto>.

<Nec minus visibilis est ea contractio quae conspicitur in rugis corporum tenuiorum> qualia sunt papyrus, membrana, vesica, pellis, folia herbarum et florum, et similia quae, cum profunditatem non habent, facile se plicare possunt. Etenim motus ille ad contrahendum ibi apparet tam validus ut superficiem corporis mutet ex plano in corrugatum, non extrusione partium (ut in carie et rubigine) sed adductione partium per nixum se contrahendi.

(fol.4v) Attamen hoc solummodo fit in <corporibus parvae crassitudinis> propterea quod in corporibus quae habent profunditatem sive crassitudinem <maiorem> ligatur nixus se adducendi in superficie corporis per continuitatem in profundo, nisi interiora fuerint mollia ita ut corrugationem non impediant ut in caseo teneriore. Quod si corpora non solum <parvae crassitudinis> sint sed insuper brevia, non tantum corrugantur corpora sed etiam <ex adductione ista> vertuntur in se, seque colligunt in involucra, ut in membrana ad ignem desiccata, atque in inflammatione papyri in quibus evidenter conspicitur non tantum corrugatio sed etiam versio in se et complicatio (12).

Atque talis est verus processus corporum consistentium et inanimatorum ad dissolutionem nisi quod sub finem, praevalente undequaque attenuatione, tertia operatio deficit non sufficiente amplius materia crassiore ad motum illum contractionis; quandoquidem omnia incipiant tanquam natare in tenuiore parte rei, atque in ipso aere qui sensim subintravit ut corpus reddatur nihil aliud quam pulvis quidam cohaerens

it shows itself both in the hardness which follows contraction of the parts, and by the cracks which now and then result from rapid drying out where some parts of an object draw themselves together so tightly that they plainly destroy the integrity of the object in other parts. However, the operation of contraction shows itself much more in the reduction and diminution which occurs throughout the whole object. The effect of this is to be seen in the kernels of nuts which, when they get old, no longer fill the shell as they once did. This effect is also apparent in beams and other wooden materials in houses or other buildings. If constructed whilst unseasoned, and even if made flush and of proper size at the start, these wooden objects nevertheless come apart and, not long <afterwards>, leave gaps <so that in these as a whole plain contraction takes place>.

<No less conspicuous is that contraction which is to be seen in the wrinkles of really thin bodies> like paper, skin, bladder, hide, the leaves of flowers and herbs, and the like which, since they have no thickness, are able easily to roll themselves up. For here the motion of contraction is so strong that it alters the surface of the body; instead of staying smooth, the surface buckles and not by a thrusting out of parts (as in corrosion and rusting) but by compaction of the parts by the force of contraction.

(fol.4v) Nevertheless this only happens in bodies <of little breadth> since in bodies with <greater> depth or thickness the force of contraction in the surface of the body is restrained by the contact it has with the matter beneath it, save when the interior parts are soft so that they do not stop the buckling - as, for instance, in softer cheese. However, if bodies are not only <of negligible thickness> but also narrow on top, they do not only buckle but <on account of that contraction>, turn in on themselves and roll up - as, for example, in parchment dried by fire, and the burning of paper in which not only is buckling easily seen but also folding up and rolling back on itself.

Such then is the real sequence of events in the dissolution of solid and inanimate bodies - except that near the end, when attenuation is at its greatest, the third operation ceases because there is no longer enough of the grosser matter left for the motion of contraction. In fact the reason for this is that everything begins, as it were, to float on the thinner part of the thing, and in the air itself which has gradually crept in so that the body is reduced to nothing more than a little dust hanging

qui levi tactu vel conquassatione possit excuti et dispergi. Talis itaque reperitur <(ut diximus) integer> processus atque progressio corporis solidi sive consistentis inanimati ad dissolutionem suam. Attamen universa ista actio triplicata vulgo per generales notiones desiccationis et consumptionis transmittitur. Hae autem notiones nihil (fol.5r) faciunt ad vias naturae pernoscendas atque indicandas quin potius seducunt intellectum ad vana remedia conquirenda per humectationes, et refocillationes, et fabulas quae nil prosunt (13). At hoc certo ponendum est sciri non posse ubi et quo modo ars naturae occurrere possit nisi prius ipsius naturae viae atque incessus explorentur et teneantur <diligenter atque in propriis vestigiis>.

<Reperitur et alia actio spiritus in processu dissolutionis rerum, atque alia rursus <hinc res pendens> actio partium crassiorum praeter triplicem illam actionem de qua dictum est. Actio spiritus est huiusmodi quod scilicet spiritus partes rei crassiores, si fuerint laxae et molles (ut fit in liquidis), non solum attenuet aut inteneret sed etiam <quandoque> separet et segreget, quandoque e contra committat et misceat. Partium vero crassiorum actio talis est quod illae quoque praecipue in liquidis non solum se contrahant localiter, sed coeant secundum homgeniam separando se localiter /A1/> (14).

</C2/ Enimvero satis non est> considerare actiones <istas quinque quae diximus> nudas et per se, sed oportet simul intueri quo modo illae varient pro natura rerum a quibus et in quibus exercentur, atque post huiusmodi verificationem seu rectificationem contemplationis per differentias debitas rite notatas, tum vero inquirere fontes <et modos> ipsarum actionum, [appetitus scilicet et affectus naturae ex quibus illae fluant], ac inde informationem atque indicia sumere quatenus et quo modo illae actiones excitari, cohiberi, intendi, atque remitti possint; ex quibus omnibus sequetur vera et fere perspicua certe praemunita via ad practicam de conservandis corporibus. Hoc igitur nunc agemus </D/>, atque postquam actiones ipsae iam explicatae sint, ad reliqua pergemus. [Semper autem intelligimus tractare nos de dissolutione illa quae fit per aetatem </B2/> absque putrefactione]. <Putrefactio autem> naturalem dissolutionem praeripit et anticipat, eadem res <est> in inanimatis quae

together which can be dispersed and shaken off with a slight touch or tremor. Such then <as we have said> do we find to be <that whole> progress and course of a solid, consistent, and inanimate body to its dissolution. Yet this entire threefold process is commonly conveyed by means of abstract notions of desiccation and consumption. Moreover, these notions (fol.5r) contribute nothing to knowing or explaining the ways of nature but rather divert the mind to searching for vain cures through moistening treatments, attempts to rekindle the vital powers (4), and other worthless fables. It must be stated specifically that it is impossible to know where and in what manner nature's art can be confronted unless the paths and entrances of nature itself have first been investigated and mastered <with diligence and in its own footsteps>.

<In addition to the threefold operation which has been discussed, another operation of the spirit is found in the course of the dissolution of things, and <following from this> yet another - an operation of the grosser parts. The operation of the spirit is of such sort that the spirit, when the grosser parts of the thing have become relaxed or soft (as happens in liquids), evidently not only attenuates and softens but <sometimes> also divides and separates or, on the contrary, sometimes brings together and mixes. Now the operation of the grosser parts is such that (in liquids especially) they too not only draw themselves together locally but assemble according to their homogeneous parts by sorting themselves out locally> (5).

<Indeed, it is not enough> to examine <those five> bare operations <of which we have spoken> in themselves. On the contrary, they ought to be considered in so far as they may vary according to the nature of things by or in which they are employed; again, after such verification and rectification of the inquiry by means of due differences faithfully distinguished (6), we ought to seek out the sources <and modes> of the operations themselves, [and the appetites and affections of nature from which they flow] and, on that basis, gather information and evidence as to how much and by what means those operations may be stimulated, contained, incited or abated. A true and, for the most part, clear and well-prepared route to practical knowledge about conserving bodies will result from all these things. This then we shall deal with now, and since the operations themselves have already been explained, we shall proceed to the rest. [Moreover, we always bear in mind that we are dealing with dissolution that comes about with time and not putrefaction]. <Putrefaction indeed> anticipates and forestalls natural

mors ex morbo est in animatis quae cursum aetatis non expectat, sed intercipit. </C1/>

</D2/> Variantur [igitur tres] <quinque> illae quas diximus actiones, vel <pro> natura spiritus sive tenuis inclusi, vel pro ratione materiae crassioris (fol.5v) quae spiritum claudit et cohibet, vel pro ratione externorum sive circunfusorum quae corpori adjacent in circuitu. <Primo itaque de differentiis spirituum, deinde de differentiis partium crassiorum, postremo loco de differentiis ambientium aut circunfusorum dicendum est. /E/> (15).

Atque spiritus ille vel ex corpore vivente reliquus est, vel ab igne inditus et excitatus. <Atque corpora quae continent et tegunt spiritus>,primi generis sunt cadavera animalium, atque etiam excrementa plantae avulsae, atque earum partes. Addimus etiam metalla et fossilia extra mineras suas prout effunduntur; etiam excocta et separata. Neque enim in excoctione metallorum inditur multum spiritus novi, sed potius multum spiritus <emittitur> atque alteratio fit praecipue in partibus rei crassioribus congregando et uniendo partes homogeneas, extrusis reliquis. Secundi generis sunt vitrum, lateres cocti, <sales>, et quaecunque a corpore molliore per ignem indurantur et coguntur. In his enim plane inditur ab igne spiritus novus, vel saltem in novam tenuitatem actus et exaltatus (16).

Sed nimirum eae differentiae spiritus quae maxime omnium ad rem faciunt sunt omnino duae: differunt enim spiritus in corporibus aut vigore, quod aliae inveniantur magis acres, vivaces et robustae, aliae magis hebetes et enerves. Atque ipse ille vigor fit vel ex natura rei, vel ex distantia temporis ex quo corpus illud desiit esse vivens; aut differunt spiritus fractione et comminutione, quod inveniantur corpora in quibus spiritus sint magis diffusi et dispertiti ut (fol.6r) minor sit portio spiritus in quacunque parte; alia vero in quibus spiritus habitent laxius et in maioribus portionibus. Atque illa rursus dispertitio spirituum in locis, in aliquibus corporibus invenitur magis aequalis ut in singulis partibus corporis spiritus magis ex aequo insinuentur; in aliis autem magis

dissolution and <is> the same thing in inanimate bodies as is death from disease in living bodies which does not wait on the passage of time but cuts it short.

[Thus the three] Those <five> operations which we have mentioned vary either <according to> the nature of the spirit or tenuous substance locked in the object, or according to the condition of the grosser matter (fol.5v) which imprisons and confines the spirit, or again, according to the condition of the external or ambient influences which closely encompass the object. <Thus, in the first place, we need to discuss the varieties of spirits, then the varieties of grosser bodies and, lastly, the varieties of external or ambient influences>.

Now the spirit is either left over from a living body, or it is kindled and excited by fire. <And bodies> of the first category <which shut in and conceal the spirit> are corpses of animals, and likewise remains of uprooted plants and parts of plants. We also include metals and mineral substances (7) torn in like manner from their lodes and, moreover, substances refined and separated. For in the refining of metals not much new spirit is imparted but, rather, much spirit <is given out> and a change takes place particularly in the grosser parts of the object through the coming together and combining of the homogeneous parts when other parts have been driven out. To the second category belong glass, fired bricks, <salts>, and all manner of things hardened or condensed from a softer body by the action of fire. Indeed, new spirit is clearly implanted in these bodies by fire or, at any rate, the spirit is urged and raised to a new tenuity.

But indisputably, the differences in the spirit which are the most significant of all are, in general, of two sorts: for spirits differ either in their bodies or in their force; for some are found to be more biting, lively, and robust, while others are duller, and weaker. Moreover, the very force proceeds either from the nature of the thing or the length of time which has elapsed since the death of the body. Alternatively, spirits vary in the way in which they are distributed and dispersed, because bodies are found in which the spirits are more diffused and dispersed, with the result that (fol.6r) the quantity of spirit in any given part is less; but there are other bodies in which the spirits have more space and larger concentrations. But, on the other hand, the distribution of the spirits in their places is found to be more uniform in certain bodies so that, in particular parts of a body, the spirits are diffused more

inaequalis ut sedes spiritus sint alibi magis laxae, alibi magis arctae et conclusae. Atque quod ad differentias spiritus in corporibus ita se res habet (17).

At partes crassiores rei duplicem recipiunt differentiam ad id quod agitur: differunt scilicet prout sunt ad duplicem illam actionem spiritus, nempe attenuationis ac evolationis, aptae vel ineptae. Includitur enim quandoque spiritus in materia non multum dissentiente ab ipso spiritu, sed parata et proportionata unde spiritus se non aegre reficere queat, atque hoc <plerunque> valet ad attenuationem. Aliquando vero in materia a natura spiritus multum remota et diversa in quam spiritus non facile agat, idque attenuationi plurimum adversatur. Rursus includitur interdum in materia porosa et cava, idque valet ad evolationem; interdum in materia sequaci et compacta, idque evolationem impedit, et meatus obstruit, et spiritum retrovertit. [Invenitur et alia differentia partium crassiorum de qua mentionem fortasse nonnullam fieri non abs re fuerit, licet eius tractatum consulto praetereamus. Ea est huiusmodi quod partes rei crassiores] (fol.6v) [in aliquibus rebus sortitae sint naturam magis simplicem et similarem; in aliquibus contra, magis dissimilarem et multiplicem. Haec vero differentia respondet aliae prorsus actioni spiritus praeter eas duas quae dictae sunt, attenuationis videlicet et evolationis (18); aliae etiam actioni partium crassiorum praeter illam quam diximus contractionis].

[Illa vero actio spiritus quae omissa est, talis est: quod spiritus (diversis rationibus de quibus nunc dicendum non est) partes crassiores rei quandoque inter se committat et misceat, quandoque separet et disgreget. Partium autem crassiorum actio itidem omissa talis est: quod illae quandoque se non tantum contrahant et arctius connectant, sed plane congregent et uniant]. [Ratio autem omissionis naturae de his tractandi in praesens ea est] </A2/ Verum de istis postremis duabus actionibus obiter tantum tractandum est> propterea quod illae pertineant magis ad dissolutionem liquorum quam consistentium (de quibus nunc est sermo), magisque rursus ad dissolutionem quae fit per putrefactionem quam <eam quae fit per> aetatem </B1/> [ut ex intentione praesenti proprie non

evenly; but in others they are distributed less evenly with the result that the spirits' residences are more spacious in one place, and more confined and circumscribed in another. This, then, is how the matter stands in the question of the varieties of spirit in bodies.

Now, in relation to the topic under discussion, the grosser parts of a body admit of a twofold difference: they differ to the extent that they are well-disposed or ill-disposed to the spirits' twofold operation of, namely, attenuation and escape. Indeed, the spirit is sometimes confined in matter quite like the spirit itself, but so prepared and proportioned that the spirit can renew itself without difficulty; and this <for the most part> promotes attenuation. However, when the spirit is situated in matter very different and distinct from the nature of the spirit, matter in which the spirit cannot act easily, that situation is very much opposed to attenuation. On the other hand the spirit is sometimes enclosed in porous and hollow matter, and that promotes escape; sometimes it is enclosed in sticky, close matter, and that discourages escape, blocks the passages, and turns the spirit back. [Other differences are to be found in the grosser parts, and it would not perhaps be inappropriate to say something about them - although we leave aside full treatment of the subject deliberately. This is the case because the grosser parts] (fol.6v) [of an object happen, in certain cases, to have a simpler and more similar nature (8), but, in others, a more differentiated and multiform one. In fact this distinction corresponds to another operation of the spirit besides the two (namely attenuation and escape) which have been discussed, and to a further operation of the grosser parts besides the one (contraction) already mentioned.]

[In fact the operation of the spirit not so far discussed is such that the spirit (for a variety of reasons which need not be spelt out at the moment) sometimes unites and mixes up the grosser parts of a thing amongst themselves, and sometimes separates and parts them. On the other hand the operation of the grosser parts (also omitted earlier) is such that not only do they sometimes contract in on themselves and bind together more tightly, but they manifestly group together and unite]. [But the reason for not dealing with these matters at present is this:]. <But what needs to be said about these last two operations is touched on only in passing> because they have more to do with the dissolution of liquids than of the solid bodies of which we now speak, and also more to do with dissolution occasioned by putrefaction than <to that brought about> by age [so that this

sit iste tractatus. Mentio autem idcirco facta est propterea quod etiam in dissolutione corporum consistentium, idque per aetatem, huius rei partes sunt nonnullae licet exiguae et obscurae].

Atque de differentiis partium rei crassiorum haec dicta sunt; pergendum itaque ad differentias quae sumuntur ex circunfusis. At circunfusa non (fol.7r) solum actiones illas spiritus et partium juvant aut impediunt, sed etiam agunt <vicissim et ipsa spiritus et partes> quin et eadem mutuo a spiritu et partibus alliciuntur, imbibuntur, et multis modis patiuntur [vicissim et ipsa spiritus et partes]. Plurima enim afferunt circunfusa ad attenuationem interdum excitandam, et irritandam; interdum sedandam, et sopiendam; rursusque ad evolationem quandoque invitandam, et quasi evocandam; quandoque comprimendam, et cohibendam; similiter ad partes rei quandoque laxandas, quandoque constringendas; quin et ipsae per actionem ipsarum propriam spiritum liquant, coagulant, extendunt, cogunt; partesque rei <crassiores> vellicant, et fodiunt, seque indunt, et immiscent, et naturam suam imprimunt, communicant, non solum violentia quadam sed potius consensu.

Itaque alia dissolutio rerum fit in aere, alia in aqua; alia foret in oleo aut liquoribus diversis; alia rursus ubi corpora ita locantur ut agitentur, alia contra ubi quiescunt; alia in calido, alia in frigido; alia in humido, alia in sicco; alia itidem ubi circunfusa eadem manent aut in eadem temperie; alia ubi subinde mutantur; alia denique prout muniuntur corpora contra circunfusa per opercula, involucra, et capsulas, alia prout ad circunfusa exponuntur; quin et alia prout ipsa corpora secundum exteriora coriis, et integumentis firmioribus (quae sunt tanquam capsulae nativae) vestiantur; alia prout fuerint magis inermia et nuda. Tales igitur sunt differentiae quae sumuntur a circunfusis quae certe eo magis sunt expendendae et pernoscendae quod (fol.7v) in illis plane versantur remedia quae ad dissolutionem corporum inanimatorum adhiberi possunt. Neque enim per os aut interiora aliquid sumi aut ministrari in illis quemadmodum fit in animalibus queat (19).

topic is not strictly to the present purpose. But it has been mentioned by the way because, in the dissolution of solid bodies, particularly by age, the elements of this business though slight and obscure are of several sorts].

But these things have been said about the differences of the grosser parts of the thing; so we pass directly to differences arising from ambient influences. Now ambient influences do not (fol.7r) just help or hinder the operations of spirits and parts but also <themselves> act <upon the spirits and parts in turn> such that these same influences are reciprocally enticed and imbibed by the spirits and parts, and are affected in many ways [themselves upon the spirits and parts in turn]. For very many ambient factors assist sometimes in exciting and arousing attenuation and, at other times, in appeasing and calming it; and again sometimes they help in attracting or as it were evoking escape, and sometimes in restraining and repressing it. Likewise they sometimes effect the loosening and, at other times, the tightening of the parts of an object; indeed they themselves even dissolve, coagulate, spread out or bring together the spirit by their own action; they tear apart and undermine the <grosser> parts of an object, and impart, interfuse themselves, and stamp or impress their nature - and not just by some sort of violence but rather by sympathy.

Consequently one kind of dissolution takes place in air; another in water; another in oil or diverse liquids; another again where objects are so situated that they may be set in motion, another, on the contrary, where they are at rest. Another sort takes place in the presence of heat, another in cold; another in moist conditions, and yet another in dry. Yet another occurs where ambient influences stay the same or in a stable condition, another where they are continually changing. Finally, another takes place according as bodies are protected by coverings, wrappings or casings against ambient influences; another as they are exposed to such influences; another as the bodies themselves are clothed, relative to environmental conditions, with skins and stronger protective coverings (which are like natural containers); and another as they are more defenceless and exposed. Such then are the differences which arise from ambient influences, differences which should certainly be considered and examined thoroughly, so much the more because (fol.7v) remedies able to arrest the dissolution of inanimate bodies are clearly to be found in them. For in inanimate bodies nothing can be absorbed or served through the mouth or internal organs in the same manner as happens in animals.

Atque constitutis iam differentiis corporum secundum materias sive externas, sive internas, in quibus actiones illae dissolutionis exercentur, superest ut inquirantur et releventur appetitus et desideria naturae a quibus actiones ipsae fluunt. Tres autem videntur affectus spiritus sive tenuis inclusi. Primus utendi et fruendi natura sua per motum et agitationem; id enim rebus quibuscunque tenuibus inest ut absolutae quietis sint impatientes, praesertim in carcere conclusi et inter contraria versantes. Secundus multiplicandi sui ac depascendi alia secundum copiam quam habent, ut et inde se conservent et augeant. Tertius exeundi et appropinquandi ad cognata et connaturalia atque cum illis se uniendi; atque ex istis fontibus actiones illae attenuationis et evolationis emanant.

Atque actio illa contractionis in partibus crassioribus duplici nititur appetitu, eoque inter se non multum diverso, neque tamen prorsus eodem. Primus <est> fuga vacui (ut vulgo loquuntur) vel abruptionis tactus ad alterum corpus. Postquam enim tenuior pars inclusa tolli et rapi caeperit, deest aliquatenus quod succedere possit unde restat ut partes crassiores se cogant in angustius et spatium desertum impleant. At alter (fol.8r) eiusmodi est quod postquam partes crassiores ponuntur in quadam necessitate obediendi partibus tenuioribus, atque illis de suo aliquid largiendi, et jacturam faciendi naturae suae, ipsae tamen sibi non desunt sed, ut constantius naturam suam tueri possint, atque minus opprimi et infestari, neque omnino immutari et destrui, quicquid reliquum est ex iis non immutatum, vires suas summo conatu colligit ad huiusmodi vim inimicam propulsandam unde fit ut partes se constipent et condensent et ordines suos (ut fit in bello) arctent (20).

At appetitus externorum sive circunfusorum nimium varia res est ut de ea in praesentia plenius tractetur. Illud tantum notari satis est quod duae reperiantur differentiae in eis quae maxime ad rem faciunt: una quod circunfusa interdum tales habeant vires quae sint, ad corpus ipsum collatae, magis robustae et valentes et tanquam praedominantes; interdum autem tales quae sint inferiores et quasi morigerae; altera, quod circunfusa quandoque magis conveniant cum spiritu

But now that the differences of bodies have been sorted out according to the internal and external substances in which the operations of dissolution occupy themselves, it remains to investigate and lay bare the appetites and desires of nature from which those very operations flow. There appear, indeed, to be three dispositions proper to the spirit or tenuous substance enclosed in gross matter. The first is to exercise and enjoy its own nature by motion and agitation; for all tenuous substances are inherently intolerant of total passivity - especially when they are imprisoned and situated among hostile bodies. The second is to multiply themselves and feed off other bodies according to the resources which they have - so that they may preserve themselves and increase. The third is to escape, and draw near to kindred substances, and to unite themselves with them. And it is from these sources that the operations of attenuation and escape emanate.

But the operation of contraction in the grosser parts depends on a twofold appetite whose aspects do not differ very much from each other, but yet are not absolutely identical. The first aspect <is> avoidance of a vacuum (as they commonly say), or breaking of contact with another body. For when the imprisoned spirit has started being removed and carried off, something able to replace it is lacking to some extent, with the result that it remains for the grosser parts to draw themselves together more tightly and fill up the empty space. But the second aspect (fol.8r) is of such sort that when the grosser parts are placed in some necessity of yielding to the thinner parts, of giving something of themselves to them, and of effecting some diminution of their own nature, they still do not neglect their own interest but (so that they can defend their own nature more stoutly, be less oppressed and troubled, and not entirely transformed and destroyed) whatever is left unaltered among them gathers its strength with a very great effort to repel this sort of hostile force. The result of this is that the parts crowd themselves together and condense, and (as happens in battle) close their ranks.

However, the appetite of external or ambient influences is too varied a phenomenon for fuller treatment at present. It is enough to note that two differences which are especially relevant are to be found in them. One is that ambient influences sometimes have such powers as are (compared to the body itself) more robust, mighty and, as it were, overbearing. At other times however, they are such as may be weaker and, as it were, compliant. The other difference is that ambient

sive tenui incluso in corpore, quandoque magis cum partibus crassioribus ut tanquam auxiliares copiae vel ad hanc, vel ad illam partem accedunt.

</AA2/> At nunc, ex illis omnibus quae iam dicta sunt, <applicanda> est inquisitio ut ostendatur quae res, <ex inanimatis et partibus tangibilibus viventium quatenus communicant cum natura inanimata> in natura et constitutione sua, magis properent ad dissolutionem, et quae minus; et multo magis in quibus mediis et qua industria curriculum illud sisti aut retardari possit ut et judicio satisfiat et practicae. Et tum demum ab inanimatis <ad doctrinam de animatis et alimentatis transeundum>. </BB1/>

(fol.8v)

<Aphorismus 5>

<Spiritus in corpore adventitii et leviter haerentes, spiritus rei innatos et immersos corrumpunt, et ad evolandum citant et praeparant, et propterea dissolutionem rei accelerant.> </δ/> </CC2/>

[Aphorismi de dissolutione rerum quae fit per aetatem in inanimatis et consistentibus] <DD1>

<Explicatio Aphorismi>

[/Aphoris.1/] Inveniuntur in corporibus spiritus debiles et leviter haerentes, et cum aere communi fere consubstantiales, et per exteriora corporis magis residentes; inveniuntur contra alii magis fortes et interiores, atque in solidis rei partibus magis impacti et immersi, atque magis ex natura et proprietate rei ut illi tanquam inquilini et adventitii habitare in corpore videantur, hi tanquam nativi et proprii. Atque primi generis spiritus in vegetabilibus ex rore fere et imbre non multo ante imbibitis innascuntur; et faciunt res leviter intumescere sed virtutes rei fortiores diluunt; hique inter distillandum primo volant et surgant unde excipiuntur primae quaeque guttae enerves et fere insipidae. At alterum genus se per alimentationem veram corpori sensim insinuavit, atque inter distillandum surgit post principia (21).

[Canon itaque conservationis primus est talis: ut corpora] <Itaque corpora illa> a prima avulsione statim ad aerem exponi

influences sometimes have more in common with the spirit or thin substance locked up in the body but, at other times, more in common with the grosser parts so that, like auxiliary forces, they incline either to the former side or to the latter.

But now, immediately after all the matters already discussed, an inquiry <should be attached> to show which things, <among inanimate bodies and the tangible parts of living beings, (as far as they partake of the inanimate nature)> hasten more in their nature and constitution towards dissolution, and which less; and, more particularly, by what means and industry the process of dissolution can be arrested or retarded so that the inquiry may satisfy both contemplation and practice. Then it would at last be possible <to advance> from inanimate bodies <to the doctrine concerning beings animate and nourished>.

(fol.8v)

<Aphorism 5>

<Spirits hanging on a body lightly and adventitiously corrupt an object's innate and immersed spirits, prepare and stimulate them to escape, and for that reason hasten the object's dissolution>.

[Aphorisms on the dissolution of things which takes place in inanimate and solid bodies with the passage of time]

<Explanation of the Aphorism>

[/Aphoris.1/] Weak and lightly attached spirits are found in bodies, and are almost the same substance as common air, and mostly situated in the outer parts of a body. By contrast, there are stronger spirits further inside, submerged and buried deeper in the solid parts of the object, and more in accord with the object's nature and character. Consequently the former seem to reside in the body as tenants or guests, the latter as original or permanent occupants. Now spirits of the first kind are those produced in vegetable substances from, for the most part, dew and rain absorbed not long before. They make the thing swell slightly but weaken its more powerful virtues, and during distillation these fly up and ascend first - whence the first weak and usually tasteless drops are collected. But the second kind has, by proper nourishing, insinuated itself into the body gradually, and ascends after the first during distillation.

[Therefore the first rule of conservation is this: that bodies] <Therefore those bodies> <ought>, at first

<debent> in frigido, ac in umbra ubi calor solis interiores spiritus sollicitare non possit, aer autem possit leviores illos allicere et extrahere <ne illi>, diutius morantes, alteros ⌊corrumpunt, et ad evolandum citant, et praeparant, et propterea dissolutionem accelerant⌋ <una secum vehant.>

<In animalibus autem in quibus longe maius scilicet inest fastidium in receptione eius succi qui vertitur in alimentum, adeo ut in omni alimentatione interveniat etiam excretio quae, plerumque nulla est aut admodum obscura, adventitii spiritus cum humore quodam sive succo excrementitio copulatur. Itaque facit plane ad diuturnitatem sudor moderatus qui ita procuratur ut interiores spiritus non minus percellat> (22).

[/Aphoris.2/] <Aphoris.8./♇/>

<Spiritus in perfectione operis sui minus est molestus et praedatorius quam in processu et ante maturitatem unde res magis servaritur in statu suo>.

<Explicatio Aphorismi 8>

<Pertinet iste aphorismus ad inanimata quae aliquando animata fuere, et propterea periodum quondam motus naturalis olim habuere>. Spiritus <enim> in corpore aliquo quod desiit vivere sunt a principio (ex reliquiis prioris naturae) magis mobiles et operosi, et in crassiores rei partes agunt magis, et quasi solita munera obire et motus imitari satagunt. Neque enim res quae diu fuere in (fol.9r) motu aliquo subito subsistant; sed postea spiritus illi deveniunt magis desides ac minus experiuntur. Itaque videmus <in caulibus> florum non penitus apertarum sed in germine, si illae statim fuerint immissae in aquam, ex eo flores expandi. Semina vero diu abilitatem suam ad resumendos priores motus (si copia iis data fuerit) retinent; neque parvo tempore effoetae fiunt. At in aliquibus plantis, ut in sempervivo maximo, radix cum sit solidus et succulentus, ad novos foetus et incrementa etiam a terra separata et suspensa sufficere potest.

Illud vero quod raro fit in herbis in arboribus familiare est, ut trunci scilicet arborum a terra excisi frondescant et ex veteri copia plane ad tempus vivant. Atque ex his manifestum est conatum illum, atque appetitum ex priore

picking, to be exposed immediately to the air, and put in a cool and shady place where the sun's heat cannot disturb the inner spirits, but where the air can draw out and extract the lighter spirits <lest they>, staying any longer, [corrupt the others and stimulate and prepare them for escape, and for that reason hasten dissolution] <carry off> the others <with them>.

<But among animals, where there is much greater selectivity in the reception of juice which is turned into nutriment, such that selectivity intervenes in all alimentation, there is also excretion of adventitious spirit which, either trifling or exceedingly insignificant, is accompanied by some moisture or excrementitious juice. Thus a moderate sweat, which so acts that it does not disturb the inner spirits, clearly contribtes to lasting> (9).

[/Aphoris.2/] <Aphoris.8/Φ/>

<As soon as the spirit has completed its work, it is less troublesome and rapacious than in the course of its work and before maturity, whence things are kept more in their original state.>

<Explanation of Aphorism 8>

<This aphorism pertains to inanimate bodies which were once living, and for that reason had a period of motion at one time>. <For> the spirits in a body which has ceased to live are at first (because of the vestiges of their earlier nature) more mobile and active, and work on the grosser parts of the body more, and (as it were) have quite enough to do in discharging their habitual functions and motions. For beings which have persisted (10) (fol.9r) in a certain motion for a long time do not suddenly stop; but afterwards the spirits grow more indolent and make fewer trials. Thus we see, <in the stalks> of flowers which are not wholly open but in bud, that blooms open out from the bud if the flowers have been put in water immediately. Given the opportunity, seeds certainly retain for a long time their capacity for resuming former motions, and do not become exhausted in a short interval. But in some plants, as in the great houseleek, the root (since the plant is solid and succulent) can suffice for new sprouting and growth even when it has been parted and lifted from the earth.

In fact, that which seldom happens in herbs (11) is commonplace in trees - namely that tree trunks put out leaves when severed from the ground, and live for a time on their existing supplies (12). And so it is manifest from these examples that the impulse and appetite, derived from their

natura actiones suas expediendi manere in avulsis. Ille vero etiam postquam defecerit in tantum ut nulla potestas repullulandi aut reminiscendi amplius rei insit, et vegetabilis natura prorsus perierit, manet tamen et initia earundem actionum exercet licet illa prosequi et perferre non possit; ut liquet in fructibus durioribus quales sunt poma, pyra, malogranata, et similia qui, licet avulsi fuerint, tamen maturescunt et intenerationem et dulcedinem qualem vivi <et pendentes super arborem> solebant, etiam avulsi nanciscuntur. Sed impensius omnino hoc fit si fuerint abrupti crudiores et immaturi, ac in tempore quo spiritus fuerint in progressu, nec ad finem actiones suae pervenerint. <Ex hoc etenim fit ut non tam maturescunt quam arefiant>.

Itaque [secundus canon talis est] <in huiusmodi rebus bene cavetur> ut res separentur a terra maturae, et quasi coctae et confectae, et tali tempore quo minime nituntur in (fol.9v) progressu sed circulum suum iam quodammodo confecerint. Alias enim spiritus nequaquam defessus, sed adhuc irrequietus et impetuosus, accelerat dissolutionem et actiones dissolutionis; ut in granis et fructibus fit qui si ante maturitatem collecti fuerint et repositi, multo magis et citius extenuantur, et desiccantur, et corrugantur. Neque id commode cedit in lignis ad aedificandum quae, propter usum corticis ad coria, excinduntur vere adulto cum maxime spiritus in opere sunt, nam ex eo fit ut tanto citius fatiscant et rimosa evadant.

[/Aphoris.3/] {/3α/} </DD2/> <Aphorismus 1>
<Quo spiritus in corpore comminuitur magis, eo corpus exit magis durabile>.

<Explicatio Aphorismi /EE1/>
</EE2/> Inveniuntur corpora in quibus spiritus magis comminuantur et distrahantur. Alia in quibus spiritus habitent laxius et plus uniantur. In metallis plurimum franguntur et diffundantur spiritus propter praedominantiam partium crassiorum quae spiritus ubique domant, compingunt, et tundunt in minima. Itaque, nisi aut spiritus <metalli> ab igne excitentur et roborentur, aut partes crassiores ab aquis

former nature, for setting their operations in motion persists in plants which have been uprooted. Moreover, when that impulse has so far failed that the plant has no strength left for sprouting again or reviving, and the vegetable nature has vanished utterly, the impulse may nevertheless remain and busy itself with the beginnings of those same operations though it cannot continue or carry them through. This is evident in harder fruits such as the apple, pear, pomegranate, and so on which, though they have been picked, nevertheless ripen and, even after picking, acquire softness and sweetness of the kind they were accustomed to have when living <and hanging on the tree>. But this happens especially vigorously if they were picked in an immature and unripe state, and at a time when the spirits were in the process of working and had not come to the end of their operations. <For, from this point onward, it happens that they do not so much ripen as dry up>.

Accordingly [the second rule is this:] <it is well noted in matters of this kind> that things should be separated from the ground ripe, and as it were cooked and prepared, and at such a time as they labour very little (fol.9v) in growth but have, in a certain manner, already run their course. For otherwise the spirit, by no means wearied, but still restless and impulsive, hastens dissolution and the operations of dissolution - as happens in grains and fruits which are wasted, desiccated, and shrivelled up much more, and also more rapidly, if they have been harvested and stored up before reaching maturity. Besides, things do not work out well for timbers used for building which, because of the use of bark in tanning (13), are chopped down fully grown when the spirits are at their most active - for from that it follows that they split open, and end up fissured so much more rapidly.

[/Aphoris.3/] <Aphorism 1>
<The more the spirit in a body is split up, the more durable does the body turn out to be>.

<Explanation of the Aphorism>

Bodies are found in which the spirits are more broken up and divided; others in which the spirits are more spaciously situated and more united. In metals the spirits are very much broken up and diffused because of the predominance of the grosser parts which everywhere hem the spirits in, overpower them, and pound them into very small portions. Thus age (as far as human observation usually conceives it) has little effect on the dissolution of metals

fortibus et mordacibus divellantur et aperiantur, non multum valet aetas (qualem hominis observatio plerunque metitur) ad dissolutionem metallorum.

Dispertiuntur etiam spiritus subtiliter in gummis, sed ob causam differentem multum a metallis <et fere contrariam. Illic enim obstinatio partium spiritum frangit. At hic> obedientia et sequacitas partium <spiritui ex aequo adest>, ubicunque enim spiritus meant ibi et illae propter lentorem suum sequuntur et circunfunduntur (23). Etenim cum materia gummorum per medullam et cortices ligni depuretur et percoletur, solummodo partes (fol.10r) exeunt tales quales spiritum comitari possint, relictis a tergo heterogeneis, ut subtiliter admodum et aequaliter spiritus cum partibus illis <commisati necesse sit>. Itaque et huiusmodi res diu durant, <et eadem ratio tenet in gemmis quae et ipsae rupium et minerarum exudationes sunt>, et aetatem ferunt (24). Eadem ratio valet etiam in oleo et pin<guedine quae similiter sunt genus quoddam exudationum aliquando a sole, aliquando ab igne, aliquando a calore animalium emissarum; atque habent propterea> spiritum cum corpore suo diligenter commistum.

</H./> [Cava enim est res aqua, respectu olei, et continet spiritus laxiores et partes <crassiores> unde et clarior est quam oleum, et mobilior, <et ponderosior>. Atque hoc optime cernitur in apertura quae fit utriusque corporis per ignem. Aqua enim inter bulliendum surgit maioribus bullis et sparsim, facili scilicet spiritu ad migrandum et corpus deserendum. At oleum et pinguia, post grana quaedam spiritus raro erumpentia et crepantia, tandem ex calore continuato surgunt in toto corpore confertim; spiritu et corpore se una attolentibus nec libenter separationem patientibus; (oportet autem exempla quandoque liquorum proponere, licet de consistentibus solum ex intentione tractetur, propter cognationem rerum)] (25).

[Nec minus cernitur eadem diversitas <olei et aquae> in misturis. Etenim omne corpus calcinatum avide imbibit oleum, et cum eo optime miscetur; at pulvis simplex non item. Contra pulvis libenter imbibit aquam; oleum vero aegre. Calcinatum autem pulvere simplici longe subtilius est, et magis comminutum, unde liquores imbibunt utraque proportionatos, licet etiam alia subsit causa in ipsa natura spiritus qui in

- unless the spirits <of a metal> are either excited or strengthened by fire or the grosser parts are torn asunder and opened up by strong and corrosive waters.

Again, spirits are finely dispersed in gums, but for a reason very different from the one relating to metals, <and practically the opposite. For in the case of metals, the toughness of the parts breaks up the spirit. But in gums> the docility and stickiness <help (14) the spirit equally>, for wherever the spirits go the parts also follow and crowd round on account of their pliancy. For when gummy matter is discharged and strained through the inmost parts and bark of the wood, only such parts (fol.10r) as can accompany the spirit go out, the heterogeneous ones being left behind - so that the spirit <is unavoidably mixed in> with the grosser parts quite finely and evenly. Consequently things of this sort last for a long time and endure the ravages of time well, <and the same cause holds good for gems which are themselves secretions of rocks and minerals>. The same cause also holds good in the case of oil and <fat which likewise are a certain sort of secretion caused sometimes by the sun, sometimes by fire, and sometimes again by the heat of animals; and so for that reason they have> spirit thoroughly mixed in with their substance.

[Compared with oil, water is certainly a hollow substance, and it contains looser spirits and grosser parts - as a result it is clearer, more mobile <and heavier> than oil. But this is best observed in the expansion (15) which occurs in each of the two substances by means of fire. For water when boiling seethes unevenly with bigger bubbles, that is to say with a spirit suitable for migrating and for leaving a body. But oil and fats, after certain grains of spirit have occasionally erupted and burst out, eventually boil in the whole mass compactly as a result of continued heat - the spirit and body neither sustaining nor gladly suffering separation one from the other; (although it deviates from the aim of discussing only solid bodies, it is sometimes necessary to set down examples relating to liquids because of the kinship of things)].

[The same disparity <of oil and water> is seen no less in mixtures. For every calcined object eagerly drinks in oil and mixes with it very well; but a simple powder does not do that. Powder on the contrary happily absorbs water, but oil scarcely at all. Moreover, a calcined body is much more subtle than a simple powder, and more finely divided, so each of the two absorb liquids adapted to them, although indeed in a calx another cause resides in the spirit's very

calce retinet aliquid ex igneo]. </Hl/> Quin etiam consistentia (fol.10v) quaeque unctuosa, id est quae habent misturam ex oleo aut pingui, magis durant; ut sunt pelles sive membranae, atque etiam ossa et cornu. <Itaque in partibus animalium exercitatio multum valet ad diuturnitatem vitae quia reddit membra, et universam corporis massam compactam, et spiritum cogit in angustius. Idem facit frigus, et nuditas pellis, <et mora sub Deo, et> in aeris temperae tolerabili (26). Etiam omnia medicamenta astringentia partes arctant, et spiritum constringunt, <quare et> proprie conservant et roborant. At contra, vita sedentaria, et <eo temperitae calida, et> mora sub tecto et vestis nimia, et balnea voluptaria et mollia unguenta laxant partes et dilatant spiritus ut facilior sit dissipatio ipsorum et, per hoc, dissolutio rei> (27).

[Canon itaque de hac re patet esse theorema tantum; idque tale est: Quod quo spiritus in corpore magis comminuuntur, eo corpus exit magis durabile.] <Hoc autem in istis quae diximus propterea fit quod> unio spirituum maxime colligat vires in <corporibus> ad evolandum et emigrandum, unde sequitur dissolutio rei. </GGl/>

[/Aphorism.4/] <Aphorismus 2>

<Spiritus in corpore impariter locati dissolutionem rei accelerant; aequaliter perfusi remorantur>.

<Explicatio Aphorismi>

Inveniuntur in corporibus nonnullis spiritus magis aequaliter perfusi, in aliis vero magis impariter locati et <partim> in maioribus, <partim in> minoribus <cavitatibus et spatiis>. Acceleratur autem dissolutio <rei non tantum a laxitate, ut in aphorismo praecedente, sed etiam> ab inaequali distributione spiritus. Ubi enim spiritus plurimum unitur, ibi maxime agit, et interposita convellit et destruit, ut cum spiritu in proximo se conjungat unde capitur initium dissolutionis. At ubi ex aequo insinuantur spiritus, comprimuntur et <desunt initia illa et veluti duces [dissolutionis] <seditionis>. Itaque facilius spiritus acquiescunt. Atque foetus plerique naturae> corpora propter summam inaequalitatem caloris coelestium <quae modo fervores, modo frigora incutientium, atque etiam propter materiam non praeparatam sed qualis adest et quasi fortuitam>, inaequalem

nature which retains somewhat of the fire]. For every unctuous, solid body (fol.10v), that is, ones consisting of a mixture of oil and fat (such as hides or skins, and bone and horn too) last longer. <Accordingly, in the case of the parts of animals, exercise promotes longevity considerably because it confers compact mass on the members and the whole body, and makes the spirit shrink. Cold does the same, so does a naked skin <and living out in the open and> in a tolerable climate. Again, all astringent medicines contract the parts and restrain the spirit, <and therefore> conserve and strengthen them properly. But on the other hand, a sedentary life <together with hot weather>, and too much living indoors, too many clothes, indulgent baths, and soft ointments relax the parts and dilate the spirits so that their dispersal is easier and, through this, the dissolution of the thing>.

[Thus the rule about this matter is seen to be merely a proposition to be proved, (16) and it is this: that the more the spirit in a body is split up, the more durable does it turn out to be]. <However, this happens in the substances which we have discussed because in <those bodies> union of spirits concentrates exceedingly the energy for escaping and migrating - from which the dissolution of the thing follows>.

[/Aphorism 4/] <Aphorism 2>

<Spirits unevenly distributed in a body hasten the dissolution of the thing; evenly diffused they delay it>.

<Explanation of the Aphorism>

In some bodies spirits are found to be more evenly diffused, but in others less evenly distributed and <partly> in greater <hollows and spaces>, and <partly in lesser>. Indeed, the dissolution <of a thing> is hastened <not only by the spaciousness> of the spirit <as was pointed out in the previous aphorism, but also> by its uneven distribution. For where the spirit is very well united it is then very much more active, and tears up and destroys what gets in its way so that it may join up with spirit nearest to it; and from this the inception of dissolution springs. But where the spirits are evenly interfused they are restrained, and <the beginnings and, so to speak, instigators [of dissolution] <of sedition> are absent>. Accordingly the spirits more easily remain at rest. But because of the extreme variability of the heat of the heavenly bodies <which produce raging heats at one moment and periods of cold at another, and also because the matter is not prepared but only such as happens to be available and, as it were, there by chance>, <very many> bodies <of

habent spiritus dispertitionem, ut plantae et metalla non repurgata; exceptis tamen corporum exudationibus (ut iam dictum est).

At <artificialia quaeque et> ignem passa maiorem aequalitatem adipiscuntur. Calor enim ignis, si sit paulo ardentior, agit res in unum, et omnes (fol.11r) subtiles rerum texturas solvit et confundit (28). Itaque lateres probe cocti, et metalla repurgata, <et porcellanea, atque vitrum et vitrificata, denique <consistentia> omnia quae resplendent si modo fixa sint, (quod aequalitatis plusquam certissimum signum est)> diu admodum durare reperiuntur. Etiam fructus passi, et carnes coctae et assatae diutius durant quam cruda. Etiam mel et cera quae a calore parvo sed subacri in ape subacta sunt, et veluti cocta, per complura secula durant tantummodo indurata (29).

[Canon itaque huius rei talis est, scilicet: Quod] <Atque omnino in naturalibus substantiis> multum facit ad durationem [rerum] <et conservationem earum> si illae ignem a principio aut calorem in modo proportionato patiantur.

<At in animalibus aequalitas illa massae quae ab igne causari potest ob tantam dissimilaritatem, et curiosam texturam, et teneritudinem, non comperit. Verum agitationes lenes, et fricationes moderatae, et simplicitas victus et alimentorum, et aeris temperes, quoad fieri potest aequalis, ea sunt quae istam aequalitatem dissolutioni inimicam massae corporis indere et tribuere possunt>.

[Causae vero eius rei variae, praecipue hoc quod agitur, quod calor ille fundendo et colliquando partes rei spiritum ubique fere ex aequo indat; alia quod (per canonem primum) ignis crudum et aqueum spiritum absorbeat; tertia quod (per canonem secundum) ignis lenis et temperatus actionem spiritus perficiat: quarta quod ignis extima sive cortices et pelles rei contrahit et claudit, ut aerem <magis> summoveat et arceat, quae omnia ad conservationem corporis faciunt].

</x/Explicatio Aphorismi 4>

[/Aphoris.5/] <[/Ad./] /B. ad Aph. 22/ [/A/]>. Partes rei crassiores, collatae ad spiritum quem circundant, triplicem sortiuntur naturam vel saltem naturae gradum. Aut enim sunt in grado proximo ad spiritum et tanquam materia

nature's birth> - as plants and unrefined metals - have an uneven distribution of spirit. Nevertheless, as has already been said, the exudations of bodies are exceptions to this.

But <all artificial objects> subjected to fire assume greater evenness. For the fire's heat, if it is not too intense, drives things together, (fol.11r) and dissolves, and confounds all the subtle textures of things. Thus bricks well baked, refined metals, <porcelain, glass, vitrified objects and, in short, all <solid bodies> which shine provided that they have been fixed (which is the surest sign of even distribution)> are found to last quite a long while. Even dried fruits, and cooked or roasted meats last longer than raw. Again, honey and wax which have been acted upon and, as it were, cooked by the slight but rather sharp heat inside the bee last for many ages - only in a hardened state.

[Thus the rule in this matter is this, namely that] <Now in natural substances generally> it is very good for <their> continuance [of things] if they endure fire or heat in suitable measure from the outset.

<But that evenness of mass which can arise from fire is not to be found in animals because of their degree of complexity, intricate texture, and softness. But gentle agitation, moderate massaging, simplicity of sustenance and nourishment, and mildness of air (as far as it may be made more equable) - these are the things which can introduce and impart that evenness inimical to the dissolution of the body's mass>.

[Indeed, the causes of this phenomenon are various; but that which is especially pertinent here is that heat distributes the spirit for the most part equally everywhere by melting and liquefying the parts of the object. Another cause is that (according to the first rule) fire devours raw and watery spirit, a third cause is that (according to the second rule) gentle and moderate fire completes the operation of the spirit; a fourth that fire contracts and closes up the outer parts or skins and hides of the thing, so that it wards off and shuts out the air <more> - all of which contributes to the conservation of the body].

<Explanation of Aphorism 4>

[/Aphorism.5/]. In relation to the spirit which they surround, the grosser parts of the thing are assigned a threefold nature or (at any rate) degree of kinship. For they exist either in the nearest degree to the spirit and

praeparata et digesta in qua spiritus libenter movetur; aut contra sunt in gradu (quoad spiritum) valde remoto, ut in illas aegre spiritus agere aut proficere queat; aut sunt mediae cuiusdam naturae, ut spiritus in eas non difficile operari et progressus facere possit.

Atque primi generis corpus subblanditur spiritui, nec eum ad actiones suas peragendas lacessit aut irritat. Itaque spiritus in ipso non moleste degens, et naturam iuxta se sui conservatricem percipiens, non admodum aut (fol.11v) de multiplicatione sui, aut de exitu laborat sed continetur placide; id quod fit in corporibus pinguibus et quae digestionem quandam passae sunt, qualia sunt oleum, gummi, cera, et similia. Itaque, et ob hanc causam <non minus quam ob fractionem spirituum de qua <supra dictum est>>, mora spiritus in eis est diuturna et dissolutio <rei> tarda (30). Atque natura huius motus remissi et minime contentiosi aut tumultuantis in spiritu manifeste se ostendit in suppuratione apostematum in viventibus. Nam postquam incipit fieri suppuratio, statim dolores et punctiones quae prius a connixu spiritus <permisti> excitatae sunt <et spiritum <ipsum animalium> per sympathiam torquent>, subsidunt et remittuntur, et manet dolor et calor tantummodo obscurus et mitis [qui certe est character quidam motus spiritus in omni corpore unctuoso et digesto].

At secundum genus corporis, cum eius sit naturae ut spiritus in illud inutiliter experiatur, <prorsus> impetum <spiritus> idcirco lassat et frangit, ut fit in lapidibus et metallis ubi spiritus, nisi excitetur ab igne aut spiritibus cognatis aquarum fortium, succumbit plane et jugum accipit; ita tamen ut si detur occasio, et veniant illa (quae diximus) in auxilium, tum vero spiritus tanto magis tumultuatur, et se expedit, et summo impetu fertur ad se liberandum, et actionem suam tam diu ei prohibitam, et impeditam resumendam et exercendam; unde fit ut etiam bullitio quaedam et fervor manifestus ad tactum in illa contentione et connixu generetur, ut fieri cernimus in dissolutione metallorum praesertim duriorum.

At media natura magis proclivis est ad dissolutionem quae spiritum nec molliter detinet, nec fortiter constringit,

as matter made ready and digested in which the spirit might be moved willingly; or, on the contrary, they exist (relative to the spirit) in a degree exceedingly remote, so that the spirit is scarcely able to struggle or make progress in them; or they are of a certain intermediate nature, so that the spirit can work without difficulty and make headway within them.

Indeed, a body of the first kind caresses the spirit and does not provoke or stimulate it to finishing its operations. Thus the spirit, living undisturbed in such a body, and sensing near itself a nature preserving it, neither (fol.11v) busies itself much about multiplying itself nor about leaving the body, but is held in peacefully; and that is what happens in greasy bodies, and ones which have undergone a certain digestion - such as are oil, gums, wax, and the like. So, owing to this cause <not less than the breaking up of the spirits which <has been discussed above>>, the spirits dwell within these substances for a long time, and <the object's> disintegration is slow. Besides, the nature of this mild and by no means aggressive motion or agitation in the spirit reveals itself in the suppuration of ulcers in living creatures. For when suppuration begins, the pains and prickings previously aroused by the effort of the <interspersed> spirit - <pains which by sympathy <rack the very spirit of animals>> - immediately die down and are relieved, and only a slight and mild pain or heat remains [which is plainly a sign of the spirit's motion in every oily and digested body].

But the second kind of body, since its nature is such that the spirit within it makes trials uselessly, <generally> tires out and breaks up the attack <of the spirit> for that reason - as happens in stones and metals where the spirit clearly yields or suffers constraint, except when it is excited by fire or the kindred spirits of strong waters. Nevertheless if an opportunity presents itself and the things which we have mentioned lend their assistance, then the spirit is indeed so much the more violent, and it makes itself ready and it is driven with extreme force to freeing itself and to resuming and exercising the operation so long denied and forbidden it. The result of this is also that in that struggle and conflict, a certain boiling and vehemence plain to the senses is generated - as we see happen in the dissolution of metals, especially the hard ones.

But the intermediate nature, (the like of which is seen in every vegetable body) which neither gently restrains nor

qualis invenitur in omni corpore vegetabili. </C/> </C/ At in animalibus, quatenus ad secundum genus materiae, nil attinet dicere. Neque enim quicquam tale reperitur in partibus animalium. Verum istis viventibus incumbendum ut massa corporis animalium inclinet potius ad primum genus materiae quam ad tertium ut <scilicet> sit plane rorida, et oleosa, et humido radicali (ut fabulantur) referta (31). Neque quis ... propterea de usu olei olivarum, aut olei amygdalini dulcis, aut butyri recentis et floridi, aut similium (32). Ista enim plane digestionem iampridem passa sunt; atque in corpus recepta magis frixa deveniunt et inepta ad nutriendum quam idonea ad id quod quaerimus. Possunt illa certe retundere acrimoniam humorum et mordacitatem, sed substantiam corporis non magnopere mutant>.

<Itaque opus est alimenti genere non quod recipiatur oleosum, sed quod post multas concoctiones et circuitus vertatur in oleosum in substantia corporis. Hoc vero praecipue conciliat /D/> (fol.12r) </D/ potus qui ex aetate, aut <multa> agitatione, aut tenui quadam depraedatione rei pinguis, summa sit praedita subtilitate ad irrorandum et irrigendum partes crassiores animalium; neque propterea habeat minus spiritus aut fervoris; nihil autem prorsus habeat ex dente, aut perforatione, aut penetratione violenta in internos aut partes ...> (33).

(fol.11v) [Itaque tale est theorema ex his quae dicta sunt; Quod scilicet pinguia et depurata non cito] </Aphorismus 4/> <Spiritus inclusus in materia in gradu propinquo ad> (fol.12r) [dissolvuntur, densa et ponderosa multo minus, media vero] <spiritum non cito [evolat] dissolvit rem, in materia valde remota multo minus, at in materia media> coagmentatio magis est dissolubilis. </x B/>

[/Aphorism.6/]. </Ad Aph. 14/>. [Sequitur canon maximi ad plurima momenti praecipue autem ad id quod nunc agitur; hoc est, conservationem viventium. Ille talis est:] Spiritus emissus corpus desiccat, detentus colliquat<[nec emissus nec detentus vivificat et membrificat]>.

Hoc vero ita se habet: spiritus, quamdiu exitus ei datur, sumptis secum partibus rei subtilioribus et sibi natura proximis, evolat unde reliqua moles rei contrahitur,

strongly checks the spirit, is more liable to dissolution. <But there is nothing to be said respecting animals as far as the second kind of matter is concerned. For no such matter is found in the parts of animals. In these living things, it turns out that the bodily mass of animals inclines rather to the first kind of matter than the third, so that it is <of course> quite dewy (17), and oily, and (as they falsely claim) filled with radical moisture. Nor should anyone ... (18) about the use of olive oil, oil of sweet almonds, or new and fresh butter, and the like on that account; for these things have clearly undergone digestion long ago, and when taken into the body become more parched and unfit for nourishing than suitable for that which we aim at. They are certainly able to check the acrimony and pungency of the humours, but they alter the body's substance considerably>.

<Thus there is need of a kind of alimentation which is not oily when taken, but which, after many digestions and circuits, turns into oily matter in the substance of the body. Drink in particular procures this> (fol.12r) < - drink which through age, or <much> agitation, or a certain fine consumption of fat substance, may be endowed with extreme subtlety for bedewing (19) and irrigating the grosser parts of animals; it does not have less spirit or vehemence on that account, but it has nothing biting, piercing or violently penetrating to the insides or parts ...>

(fol.11v) [Thus, from what has been said, the proposition to be proved is this: namely that fatty and strained substances are not quickly] </Aphorism 4/> <Spirit imprisoned in matter near in degree to> (fol.12r) <the spirit does not quickly [escape] dissolve the object; in matter exceedingly remote, much less; but in intermediate matter> [dissolved; dense and heavy bodies, much less; in intermediate bodies indeed] the compounded mass is more liable to decomposition.

[/Aphorism 6/] </Aphorism 14/> [A rule follows of great consequence for very many things, but especially for the matter in hand; that is, for the conservation of living things. The rule is this] Spirit emitted dries a body up, spirit retained liquefies <[but neither emitted nor retained, vivifies and forms members]>.

The reasons for this are as follows: provided that the spirit is given a way out, and when it has appropriated to itself the subtler parts of the thing and what is closest

inspissatur, atque induratur (ut supra dictum est). Quod si exitus spiritui non detur, vertit se spiritus et vires suas in partes rei crassiores, easque attenuat et solvit, non statim in spiritum (neque enim tam facile obediunt), sed in liquidum qui est gradus versus spiritum, in quo etam spiritus interim magis commode movere et perfungi possit. Atque haec est causa vulgaris illius effectus qui ubique cernitur; scilicet, quod ignis contrarias edat operationes: alia indurando et vertendo in siccum, alia molliendo et vertendo in humidum, quia spiritus in illis emittitur, in his detinetur.

Sed (quod nunc agitur) manifestum est in plurimis quod cohibitio et detentio spiritus in corpore omnis conservationis praecipuum fundamentum est, idque tam in liquidis quam in consistentibus. Nam aqua et vinum et succi omnes optime conservantur in vasibus diligenter obturatis et conclusis. Neque requiritur tantum obturatio diligens, verum etiam repletio exacta ne, inter operculum et liquorem, aliquid maneat aeris quod spiritum rei lacessere et sollicitare possit. Itaque etiam ad illud non malum invenerunt remedium ut parum <olei> superfundatur quod aerem quemcunque omnino summoveat ex proximo.

At in consistentibus (fol.12v) videmus ligna colorata, et pigmentis (praesertim iis quae habent oleum) depicta, aut vervice obducta, aut pice, aut aliquo ex gummis oblita, diu conservari nec humido suo facile destitui. Etiam fructus (quae res est tenerior), atque ex iis etiam humidiores (ut uvae), bene diu servantur in farina quae et ipsa potis est aerem (in corpore sive congregatum) excludere. Etiam de cera, et melle, et saccharo similia affirmantur, non solum quoad fructus sed etiam quoad carnes (34). Sed neque hic finis. Nam non tantummodo per huiusmodi cohibitionem transpirationis servatur humidum in rebus, sed etiam videtur humidum recuperari et instaurari posse propter eam quam diximus causam; videlicet quod spiritus bene retentus, loco confectionis aut versionis tenuis in spiritum (quod facit cum datur exitus), vertit crassum in humidum, unde intenerantur res et quasi reverdescunt.

to it in nature, it escapes - as a result of which what remains of the mass of the thing contracts, thickens, and hardens (as has been said above). But if the spirit is not given a way out, it turns itself and its powers on the grosser parts of the thing, and attenuates and dissolves them - not into spirit straight away (for the parts do not yield so easily),but into liquid which is a step towards spirit and, indeed, a substance in which spirit can move and act more conveniently in the meantime. This, indeed, is the cause of that common effect which is seen everywhere - namely that fire brings about contrary operations: on the one hand, in hardening and making things dry and, on the other, in softening and making moist, by virtue of the fact that in the former case the spirit is let out and, in the latter case, held back.

But (and this is what matters here) it is obvious in many instances that confinement and detention of spirit in the body constitute the essential foundation of all conservation, and that as much in the case of liquids as in the case of solids. For water, wine, and all juices are best conserved in vessels carefully sealed and stopped up. Not only is careful sealing required, but also complete filling so that, between stopper and liquid, no trace of air is left which could stir up and provoke the spirit of the thing. Thus, in fact, have they found a passable solution to this problem by pouring a little oil on top of the liquid, which altogether removes air from the immediate vicinity.

But in the case of solid bodies (fol.12v) we see that coloured timbers painted with pigments (particularly those which contain oil), or soaked with vinegar, or smeared with pitch, or some resinous substance, are preserved for a long time and not easily deserted by their moisture. Likewise, fruits (whose matter is softer), and particularly the juicier among them (as grapes) keep well for a time in flour which is in itself able (in a body or surrounding them) to exclude the air. Moreover, similar things are confirmed concerning wax, honey, and sugar - not only in respect of fruit but of meats too. But that is not all; for not only is moisture kept in things by the curbing of such transpiration, but the moisture also seems able to recover and restore itself for the reason which we have already mentioned - namely that when the spirit is well retained, instead of dissolving and turning the thin matter into spirit (which the spirit does when it is given a way out), it converts the gross matter into moisture - whence things are softened and, as it were, reinvigorated.

Atque res videtur certa sed modus scrupulosus, et qui libratam admodum operationem desiderat. Etenim quod spiritus retentus (qui alias solummodo in tenuiores rei partes acturus fuisset) partes solidores digerat et conficiat; res certa quodque illae per hoc non contrahant se aut indurent (ut fit cum emittitur tenue) sed potius se laxent, et cum tenuioribus magis communicent, et humidae magis deveniant; res itidem certa, sed interim illud malum intervenit quod multiplicatur spiritus et augetur quanto suo propterea quod nullus emittatur et novus subinde reficiatur, ipse vero auctus tanto magis in partes rei potest et agit - unde illae magis certe commistae, sed nihilominus magis putres et exolutae reddi possint. Quod vero augeatur spiritus ex illa detentione, res manifesta est. Nam cum tantum de corpore transeat in spiritum cum datur exitus multo magis necesse est (fol.13r) accelerari eam actionem et intendi cum exitus non datur. Neque enim ita se vertit spiritus ad subigendas partes rei crassiores in humidum, ut non simul vertat multum ex partibus tenuioribus in spiritum.

Itaque (quandoquidem haec magis evidenter se ostendant in liquoribus) videmus mustum et cerevisiam novam, in utribus exacte obturatis conclusae, plena spirituum ventosorum et floris. Etiam experimentum fructus (qualia sunt cotonea et pyra et similia) cera undequaque obductorum fere eo cedit ut illa reperiantur madida, et tanquam macerata, et aqueo sudore perfusa propter excessum et nimiam digestionem spiritus aucti. Itaque melius (ut diximus) adhibetur farina, aut arena subtilis, et pulveres laevigati ad fructus servandos (quae aerem non prorsus arcent, nec spiritum omnino suffocant) quin eius nonnihil emitti possit, quaeque etiam absumunt humorem et exugunt (quod faciunt omnes pulveres) quam cera aut aliquid aliud quod transpirationem spiritus magis peremptorie prohibeat. Quod si fieri posset ut spiritus tali modo detineretur ut partes crassiores intenerari, neque tamen spiritus in quanto suo nimium augeri aut in calore suo incendi possit, negotium confectum foret in vivis quae capiunt alimentationem. Sed negotium (ut diximus) scrupulosum et quod magna cautione transigi vult. Arcta enim et angusta via est inter intenerationem et putrefactionem. Sed hoc est quod initio diximus, hunc aphorismum ad praesens argumentum

This matter seems true, but it is a delicate business and one which requires very judicious execution. For the retained spirit which on another occasion might have been about to work on the thinner parts of the thing, tears apart and destroys the more solid parts; and it is also certain that because of this the solid parts do not draw themselves together or get harder (as happens when a tenuous body is emitted) but rather they relax themselves and associate more with the thinner parts and become more moist. But this likewise is a matter of certainty - that a misfortune intervenes in the meantime, for the more the spirit multiplies and increases itself and truly becomes abundant (because nothing is emitted and new spirit is presently recruited), the more power it has, and the more it works on the parts of the thing - as a result of which the parts are certainly more mixed together, but can nevertheless be made more putrid and loose. It is obvious that the spirit may indubitably increase by reason of that detention; for since so much of the body is converted into spirit when the latter is given an outlet, so much the more is it essential (fol.13r) to hasten and prompt this operation when no outlet is given. For just as the spirit does not set about turning the grosser parts of the thing into moisture, so at the same time it also does not turn much of the thinner parts into spirit.

Thus, since these phenomena show themselves more manifestly in liquids, we see that wine and new beer tightly sealed up with stoppers are full of windy spirits and froth. Moreover, the experiment of coating fruit (such as berries, pears, and the like) entirely with wax almost comes down to this - that they are found to be moist, and as if macerated and suffused with a watery sweat because of the excess, and excessive digestion of the increased spirit. Thus, as we have said, flour, fine sand, or smooth powders are better used for keeping fruit than wax or anything else which blocks the spirit's transpiration completely; for these are substances which do not shut out the air absolutely, nor wholly stifle the spirit such that it cannot be emitted, and each of these substances also takes away and sucks out moisture (as all powders do). For if it can happen that the spirit may be held back in such a way that the grosser parts are softened, but nevertheless not so that the spirit can increase its bulk excessively or be consumed in its own heat, the business might be accomplished in living things which take nourishment. But, as we have said, the business is tricky and needs to be undertaken with circumspection, for the way between softening and putrefaction is strait and narrow. But this is what we said at the start,

scilicet instaurationis viventium summopere pertinere.

Atque omnino res digna est in qua omnis adhibeatur diligentia praesertim cum viventia et maxime corpus humanum infinita suscipiat (fol.13v) remedia et auxilia, quae inanimatis nullo modo competunt, per quae beneficium detentionis spiritus recipi possit et maleficium quod ex eo sequitur nihilominus per accommoda diversi generis prohiberi et reprimi, ut paulo post loco suo demonstrabitur (35).

Patet autem detentionem spiritus fieri tribus modis. Aut enim fit ex substantia ipsa rei bene compacta et unita, ut in metallis, gummis, oleis, syropis ad densitatem coctis, et huiusmodi; quod etiam cernitur in foliis plantarum splendentibus quaeque hieme virescunt, ut in lauro, haedera, et similibus, quae coeteris sunt diuturniora. Aut fit ex densitate corii seu pellis, ut in fructibus atque animalibus (cavit enim natura ut corpora fere teneriora pellibus obdurantur); aut fit per opercula, et superpellitia, et linimenta, ut cernitur in conservatione liquorum atque in lignis pictis quemadmodum <idem> dictum est (36). Neque porro nihil facit ad diuturnitatem vitae mos pingendi corpora qualis et apud antiquos Britannos et nunc temporis apud occidentales Indos, Virginienses, et Brasilienses invaluit, qui omnes etiam longivi habiti sunt et habentur [ut suo loco dicetur] (37).

<Aphorismus 12>

<[Explicatio Aphorismi 12]>

[/Aphoris.7/] </Ad.14/> [Sequitur quoque aphorismus ad multa pertinens] Spiritus evolans in consistente siccat, in liquido separat. At detentus in consistente conservat et intenerat, in liquido conservat et commiscet, [in lento et sequaci vivificat].

<Explicatio Aphorismi 12>

Atque de desiccatione atque inteneratione dictum est in aphorismo praecedente (38). At de separatione, commistione, (fol.14r) [et vivificatione] iam dicendum est; nam conservatio atque exolutio ad utrunque pertinet. Ut igitur patefiat ratio

that this aphorism is especially relevant to the present argument - namely to the question of the renewal (20) of living things.

Moreover this is altogether a noble enterprise in which all care must be employed - particularly since living beings and, most of all, the human body may receive infinite (fol.13v) helps and remedies (which do not by any means coincide with those for inanimate beings) whereby the benefits of the spirit's detention can be retained, and the harm resulting from it can nevertheless be warded off and restrained by appropriate means of various kinds - as will be demonstrated shortly.

But it is evident that detention of spirit happens in three ways. For it comes about either by reason of the very substance of the thing, well-compacted and united - as in metals, gums, oils, syrups thickened by cooking, and the like. It is likewise apparent in bright leaves of plants which grow green in winter - as in laurel, ivy, and similar plants - leaves which last longer than others. Alternatively, the spirit's detention is effected by the thickness of rinds or skins - as in fruits, and also in animals; for nature has taken care that in general the more tender bodies are protected with skins. Lastly, it is effected by coverings, outer coatings, and liniments - as is seen in the conservation of liquids and painted timbers, as has been explained above. Moreover, nothing contributes so much to longevity as the custom of painting bodies - the like of which prevailed amongst the ancient Britons and, in our time, amongst the Indians of the west, the Virginians, and the Brazilians who all indeed were and are known to be long-lived [- as will be explained in its place].

<Aphorism 12>

<[Explanation of Aphorism 12]>

[/Aphorism 7/] </To 14/> [An aphorism follows which is also relevant to many things] An escaping spirit in a solid body dries it out; in a liquid one, it separates it. But spirit trapped in a solid body conserves and softens it, whereas in a liquid it conserves and mixes it together; [in a pliant and sticky substance, it vivifies].

<Explanation of Aphorism 12>

Both desiccation and softening have been mentioned in the preceding aphorism. But now separation and mixing (fol. 14r) [and vivification] are to be discussed; for conservation and loosening are relevant to them both. Thus, so that the

separationis et commistionis, primo ponendum est (quod dubio caret) omnes scilicet partes cuiusque corporis homogeneas appetere ut congregentur et uniantur nisi aliquo vinculo impediantur sive ligentur. Hoc posito, videndum quid sit id quod partes corporis ita liget ut, licet sint heterogeneae, tamen contentae sint mansione sua prout locantur neque se unire contendant, quod illis proprie est in desideriis (39).

Videtur autem duplex esse vinculum aut ligatio, eaque multum inter se diversa. Primum enim vinculum videtur esse ex natura spiritus; secundum autem ex natura partium crassiorum. Itaque in liquoribus ubi partes rei sunt laxiores, ut facilis (quoad ipsas) foret congregatio ad homogenea, videntur certe spiritus vinculum esse praecipuum ligaturae. Nam spiritus obtinent in huiusmodi corporibus dominatum quasi regium (40), ex quo fit ut singulae partes eorum crassiores maneant in eo situ et positura non quae ipsis magis sit in votis, sed quae spiritui magis sit commoda. At postquam spiritus emigravit <vel suffocatus fuerit>, redeunt utique singulae ad suum proprium fluorem sive chao. Id cernitur in sanguine quae, postquam spiritus exhalaverit, solvit in aquam, et foeces, et florem. Atque simile fit in urina et jusculis carnium quae, itidem refrigerata, separantur, residente crasso, supernatante pingui, aqueo vero media (fol.14v) occupante. Atque haec tamen rursus admota paululum ad ignem denuo commiscentur nonnihil, et incorporantur, et clarescunt ut usu venit in urinis quae, postquam exolutae et perturbatae fuerint, ponuntur a medico super parum ignis unde excitato spiritu, tales deveniunt fere quales emissae fuerunt (41).

At contra in consistentibus vinculum quod heterogenea colligat consistit in ipsa firma et arcta compage partium crassiorum quae motum <ita> exhorrent <ut> magis contentae sint ut manere in statu quo sunt, licet copulata cum dissimilibus, quam se ponere in motu ut socientur cum similibus. Itaque in liquoribus sufficiebat privatio spiritus qui impedimento erat partibus ut congregarentur; sed in consistentibus opus est actione aliqua spiritus ad hoc <ut> partes se ad congregandum excitent. Nisi enim invalescat spiritus et roboretur a calore idoneo, ut tota massa ponatur in motu, non congregant

cause of separation and mixing may be disclosed, it must first be stated (and the point is indubitable) that all the homogeneous parts of any body whatever strive of course to group together and unite unless restrained or tied by some bond. Now that this has been posited, we must see what it is that binds the parts of a body in such a way that, although heterogeneous, they are nevertheless happy with the situation that they find themselves in, and do not strive to unite, which is what they want to do especially.

Now this chain or bond seems to be of two kinds, the one very different from the other. The first bond seems to arise from the nature of the spirit, but the second proceeds from the nature of the grosser parts. Thus in liquids where the parts of the substance are looser, such that the coming together of the homogeneous parts (21) would be easy were it up to them, the spirits certainly appear to be the principal binding agent. For the spirits hold, as it were, royal authority in bodies of this kind - with the result that their individual grosser parts stay not in that position or situation that accords with their own desires, but in ones more to the liking of the spirit. But once the spirit has departed <or has been stifled>, the individual parts are certainly reduced to their own proper fluidity or confusion. We see that clearly in blood which breaks down into water, dregs, and froth once the spirit has exhaled. Moreover, a similar phenomenon occurs in urine and gravy which, once cooled, are separated out into gross matter which sinks down, fatty matter which floats above, while the middle place is taken up by watery matter. (fol.14v) Nevertheless, when these are exposed to fire a little, they are somewhat reconstituted, reincorporated, and clarified - as happens in urine samples which, once they have been relaxed and agitated, are placed by the physician over a gentle flame with the result that when the spirit has been aroused, they return almost to the same condition as when they were passed.

But in solids on the other hand, the bond uniting the heterogeneous particles consists in the structure itself, strong and tight, of the grosser parts which <so> dislike motion that they are more content to stay in their original state (though united with dissimilar bodies) than to set about moving in order to ally themselves with similar bodies. Thus in the case of liquids, removal of the spirit which was preventing the parts from uniting is enough; but in solids some action of the spirit is required for exciting the homogeneous parts to come together. For unless the spirit grows strong and is invigorated by suitable heat so that

se homogenea. At certe si spiritus acrior fodiat partes crassiores et torporem illum naturae crassae et haerentis discutiat et poros aperiat, tum demum et illae se separant et partes quaeque ad connaturalia sua recurrunt. Itaque in unguentis ubi adeps aut oleum cum aqua aut succo aliquo per agitationem et contusionem leviter incorporantur, statim mediante (fol.15r) exiguo calore, eadem aqua et oleum se repetunt. Atque in lignis, foliis, et similibus, postquam spiritus ab igne excitatus est et partes crassiores etiam stimulatae et in motu positae, aquea pars abit in fumum, oleosa in flammam, et cinis exuitur et decidit; aut si cohibeatur evaporatio, et inflammatio (ut in distillationibus) solvuntur illa in oleum, et aquam, et foeces (42).

<Itaque manifestum est et frigus et calorem officia separationis <utique> edere posse, sed diversa ratione (ut non sine magna imperitia posuerit Aristoteles calorem congregare homogenea, separare heterogenea) cum calor hoc faciat per discussionem torporis et congelationis qui inest omni corpori consistenti versus motum, et tum demum sua natura libere uti possint; frigus autem hoc faciat per liberationem corporis crassioris a dominatu spiritus> (43).

<Verum illud> sequitur tam in liquidis quam in consistentibus, quod detentio spiritus sit illud quod conservat res maxime in statu suo, et exitus eius <contra> res solvit in partes suas similares. Lapsus vero ille et remeatio ad homogenea in refrigerationibus liquorum < fit modo leni> et clandestino; in accensionibus vero consistentium cum tumultu. Quod vero dictum sit non solum conservari liquida per detentionem spiritus, verum etiam commisceri et contemperari. Illud vero supra demonstrandum est in exemplo urinae et similium quae a spiritu per ignem indito et redintegrato (quod idem est ac si spiritus detineretur) de novo commiscentur per dissimilaria (44).

Quin etiam spiritus detentus non tantum committit inter se et commiscet partes liquoris crassiores, verum ipse quoque cum iisdem subtilius commiscetur ut fit in cervisia et vino quae, si fuerint annosae et in vasibus contentae bene clausis, deponunt omnem asperitatem, et deveniunt lenia et mollia,

the whole mass is set in motion, the homogeneous parts do not gather themselves together. But assuredly if a sharper spirit digs into the grosser parts, dispels the sluggishness of the gross and clinging nature, and opens the pores, then at last do the parts separate themselves, and every one of them returns to its connaturals. Thus in ointments, where grease or oil are mixed a little with water or some juice by shaking or beating, (fol.15r) the same water and oil are themselves immediately brought back by means of slight heat. Moreover, in the case of pieces of wood, leaves, and the like, once the spirit has been aroused by heat and the grosser parts have been stimulated and set in motion likewise, the watery part disappears in fumes, the oily part in flame, and the ashes are cast off and sink down. Alternatively, if the evaporation and burning are confined as in distillations, those substances are broken down into oil, water, and a residue.

<Thus it is manifest that both cold and heat are <undoubtedly> able to discharge the offices of separation but for different reasons, since heat causes separation by dispelling the inactivity and rigidity respecting motion which exist in all solid bodies, and then at last they can exercise their own nature freely; but cold causes separation by freeing the body from the spirit's sovereignty - so not without great ignorance did Aristotle suppose that heat brought homogeneous parts together, and separated heterogeneous ones>.

<But what> follows is <true> both in the case of liquids and of solids - that detention of spirit is what most keeps things in their original state and, <on the contrary>, the spirit's escape divides substances into their homogeneous parts. In fact, in the cooling of liquids this reduction and return to homogeneous parts <happens by gentle> and secret <means>; in the burning of solid bodies, however, it happens with violent commotion. But indeed it might have been said that liquids are not only conserved but also mixed and tempered by detention of spirit. Indeed, that has been demonstrated above in the instance of urine and the like which, once the spirit has been stimulated and renewed by fire (which is the same as if the spirit were detained), are mixed together anew throughout the heterogeneous parts.

Yet the imprisoned spirit does not only act on and mix up the grosser parts of a liquid among themselves, but it is itself more subtly intermixed with the grosser parts - as happens in beer and wine which, if they are old and have been well confined in sealed vessels, put off all their harshness

atque (ut loquitur Anus in comedia) vetustate edentula quia amplius non mor- (fol.15v) dent (45); hoc vero certissimum est signum spiritus cum partibus liquoris tenuiter subtilizati et commisti. Spiritus enim non bene comminutus pungit et linguam convellit.

<Iste vero aphorismus magni usus est ad cognoscendas vias alimentationis de quibus postea dicendum est quia congregatio ad similia et effectio similium, quae est ipsa assimilatio sive alio nomine alimentatio, actiones affines sunt> (46).

Superest vero ut de vivificatione quae fit per detentionem spiritus nonnulla subjungamus, non tam rei ipsius gratia (hoc loco) sed <propter relationem ad priora duo>. Videtur enim omnis vivificatio esse quiddam medium inter detentionem et emigrationem spiritus. Ubi enim spiritus pergit ad exitum, sed tamen nec emittitur nec retrovertitur, sed incidit in materiam obedientem et sequacem quae cohibet spiritum nonnihil, <ita tamen ut spiritus dilatet se localiter, et vias ad exeundum tentet, et materiam simul ante se agat, et prout apta est effinget>, sequitur vivificatio. et membrificatio, et corpus organicum, et huiusmodi (47). Etenim simplex illa et mollis protrusio, et ante se actio partim rei (quae videtur res contemnenda et invenitur in <putredine> et musco), est procul dubio rerum rudimentum in altero naturae animalis, in altero naturae vegetabilis, et principium ipsius vivificationis. et membrificationis, et corpus organici et figurati (48).

Itaque plane cernitur quandoque muscus paulo arctior devenire herbidus, et formatus, et instar pusillae plantae (49). <Putredo> autem facile transit in vermiculos, etiam motu se manifestante antequam efformatio sit absoluta (50). Neque contemnendum videtur quod ab aliquibus non alioqui vanis aut credulis narratur de pyrausta speciali quodam (fol.15a r) qui generetur in fornacibus cupriis, qui vitalis cernatur, sed statim a fervore ignis vel <minime> remotus perit (51). Possit enim esse analogia talis inter spiritum acrem ab igne excitatum, et corpus durum et metallicum et tamen sequax, qualis sit inter spiritum delicatum animalium et corpus itidem molle et

and become gentle, soft, and (as the old woman in the comedy says) toothless with age because they do not bite any more. (fol.15v) In fact, this is generally the surest sign of spirit finely subtilized and intermixed with the parts of the liquid; for spirit not well distributed stings and tears at the tongue.

<Indeed, this aphorism is of great use for knowing the ways of alimentation (of which something will be said later), because the gathering together of like substances (22), and the production of like substances (which is itself assimilation or, by another name, alimentation) are related processes>.

However, it remains that we subjoin something about vivification (a process which results from detention of the spirit) not so much, at this point, for the sake of the thing itself, but <because of its connexion with the previous two operations>. For it seems that all vivification is a certain intermediate state between detention and escape of the spirit. For where the spirit strives for release, but is nevertheless neither sent out nor turned back, then vivification results, and the fashioning of members, an organised body, and things of that kind - assuming that the spirit lights upon compliant and sticky matter which somewhat hinders it <but in such a way that the spirit swells itself locally, casts around for escape routes, and at the same time drives matter before it, and (according as the matter has been prepared), fashions it>. For that simple and gentle thrusting out, and before that the operation principally of the thing itself (which seems a phenomenon of little consequence and one found in <putrefaction> and moss), is without doubt the beginning of things - of, on the one hand, the animal nature and, on the other, of the vegetable nature; it is the principle of vivification itself, of the fashioning of members, and of an organised and figured body.

Thus a little thicker moss is clearly seen at times to become verdant, formed, and like a tiny plant. <Putrefaction>, moreover, easily turns into worms, motion exhibiting itself even before their formation be complete. Nor should we despise what we are told by some people not otherwise vain or credulous, about a particular fly of the fire (fol.15a r) which is spawned in copper furnaces, and is seen to be alive but, once <the least> removed from the fury of the fire, perishes immediately. For there could be such a correspondence between the active spirit aroused by fire, and a hard, metallic but nevertheless sticky substance, as there is between the tender spirit of animals, and a body soft and

lentum; ideoque extra flammam statim perit quia, remissa ignis vi, nec spiritus amplius movere possit sed torpeat, nec corpus metalli manere ductile sed confestim obrigeat. <Sed huc fortasse fabulosum fuerit>.
(fol.15a v: blank)

PART B
(Bacon's autograph)

(fol.16r)

</[C1] E2/>. Illud vero <ponendum est> tanquam postulati loco vel sumendum potius, cum nihil sit certius, omne ens <tangibile> eorum quae nobis cognita sunt (nam qualis sit corporum condensatio versus interiora terrae haud facile cogitationem humanam subit) habere et in se percontinere <perpetua ex subactione et concoctione solis et coelestium> spiritum <commistum et inclusum> (52). Neque vero iste spiritus vis est quaedam, aut energia, aut nugae, sed plane corpus tenue partibus rei crassioribus obductum et obsessum. <Neque rursus est iste spiritus aer exterior qui se insinuavit et subintravit, sed plane tenue innatum et ab aere diversum> (53).

Atque ex isto corpore tenui pendet omnino rerum dissolutio. Partes enim rei crassiores et tangibiles et ponderosae, licet ipsae habeant fluxum suum, tamen per longa temporum spatio in suo esse et statu permansura forent, nisi a spiritu illo suffoderentur et destruerentur. Hoc posito, pergendum iam ut dictum <est> (54) ad inquisitionem differentiarum huiusmodi spiritus <qui> orbem istum et revolutionem per quem res vergunt ad suum occasum potiore ex parte, et ut primus motor, regit.

Differentia autem primaria et plurimi ad omnia momenti ea est: spiritus entis aut intermistus <est>, aut ramosus, aut cellulatus sive cum universitate (55). Spiritus intermistus ille est qui a se per partes rei crassiores penitus abscissus est [ut in aer, in nive, aut spuma]. Atque iste spiritus invenitur in omni ente tangibili inanimato, et in mole et partibus tangibilibus omnis entis viventis. Spiritus ramosus sibi continuus est per poros <et meatus> suos, sed <ista continuatio datur tantum> per lineas exiles et canales minutos;

pliant in the same way; and therefore the fly perishes at once outside the flame because, the fire having weakened in force, neither can the spirit move any longer but becomes inactive, nor can the body of the metal stay pliant but solidifies into a compact mass. <But this may, perhaps, be a tall story>.
(fol.15a v: blank)

PART B
(Bacon's autograph)

(fol.16r)

Since nothing is more certain it <should> assuredly <be affirmed> or preferably taken for granted in place (as it were) of a postulate, that every <tangible> being possesses and holds a spirit within itself. Knowledge of the kind of density proper to bodies further down in the earth's entrails is by no means easy to acquire, but among those known to us every one has this <intermingled and enclosed> spirit <on account of the perpetual refining and subduing influence of the heavenly bodies>. (23) However, this spirit is certainly not some force, or energy, or trifling thing but is clearly a thin body distributed and invested in the grosser parts of the object. <Nor, again, is this spirit outer air which has covertly stolen in or insinuated itself but simply a thin and innate body different from air>.

Now the dissolution of things depends absolutely upon this thin substance. For the grosser, tangible, and heavy parts of an object (although these have their own variability) would nevertheless survive in their essence and condition if it were not that the spirit undermined and tore them to shreds. This laid down, we proceed as <has been> said already, to the investigation of the differences of this kind of spirit - <which spirit> as a first mover rules through superior power this globe and the process by which things decline to their destruction.

Indeed the principal difference, of cardinal importance for all kinds of things, is this: the spirit of a thing <is> either intermixed, or branching, or located in cells and with a general meeting-place. Intermixed spirit is that which is completely divided within itself throughout the grosser parts of the object [as in air, snow, or froth], and this spirit is found in every inanimate and tangible thing, and in the mass and tangible parts of every living being. Branching spirit is by means of its pores <and passages> joined to itself, but <this continuity is only provided for> by slender passages and tiny channels; and the

qualis est spiritus omnis vegetabilis. At spiritus cellulatus et ipse scilicet ramosus est, sed habet cellam; id est, <arta> loca et spatia, <cavaque in rei> ubi spiritus <congregatur>, purus et per se, in quanto pro ratione rei notabili et bene magno ad quem rivuli illi spiritus <ramosi> se referunt tanquam ad universitatem. Atque huiusmodi est spiritus omnis sensibilis (56).

Itaque omne vegetabile et sensibile etiam organicum est propter cohaerentiam et integralitatem spiritus qui faber rei est. Haec, licet sint evidentissima, tamen monendi <videntur> homines ut corporum invisibilium naturas et rationes diligentius teneant et persequantur quia (ut nunc fit res) contemplatio fere desinit cum aspectu, cum tamen illa corpora invisibilia pertentent <omnia> et percollant, <ita ut> actiones <ipsae> rerum et virtutes quas vocant (57) nil aliud sint quam eorum ipsorum clandestini impetus et motus quos, nisi quis probe et distincte novit, nemo speret sermones perducere ad opera.

</[Nota de abruptione contemplationis cum sensu, et de necessitate absque omni desperatione huius realis subtilitatis]/> (58).

Verum ut ad propositum reditamur. (fol.16v) Etiam in spiritu illo intermisto duplex subest differentia utraque ad continuationem pertinens, alia videlicet comminutionis, alia <imparitatis sive> inaequalitatis. Inveniuntur enim corpora ubi spiritus sunt magis comminuti et contusi per minima. Inveniuntur autem alia corpora ubi spiritus habitant laxius et per maiores portiones. Rursus inveniuntur corpora in quibus spiritus magis ex aequo insinuantur. Alia vero ubi disperguntur et locantur magis inaequaliter. Atque hic absolvimus explicationem magnae illius differentiae spiritus in entibus quae ad tot et tanta pertinet, quae <ea videlicet> capitur ex continuatione spiritus.

Sequitur alia differentia spiritus entium non minor quae capitur ex ipsa substantia, complexione, et vigore spiritus. Inveniuntur enim in corporibus spiritus magis acres, vivaces, et robusti. Inveniuntur etiam magis hebetes et enerves; atque, ut planius dicamus, alii magis consubstantiales aeri, alii magis consubstantiales flammae. Omnis enim spiritus rerum est

spirit of all things vegetable is of this kind. However, spirit in cells is itself evidently branching, yet it also has a cell. It has, in other words, <confined> places, and spaces, <and hollow regions within the thing> where the spirit <congregates>, pure and in itself, in such quantity as befits a great and remarkable business, and to which spirit those very <branching> streams of spirit resort as if to an assembly; and indeed all sensible spirit is of this kind.

Thus all vegetable and sensible being is organic because of the coherence and integrity of the spirit which is the architect of the body. These points, though they are perfectly plain, <seem> nevertheless to admonish men to seek out and grasp the natures and causes of invisible bodies because, as the case stands at present, investigation virtually breaks off where sight ceases since those invisible bodies nonetheless pervade and permeate <all things> <in such a way that> what they call the very actions and virtues of things are nothing other than the secret impulses and motions of those very same bodies - and unless one acquaints oneself with those impulses rightly and distinctly, no one may hope for doctrines leading to works.

</[Note concerning the breaking off of investigation on reaching the threshold of the senses, and concerning the need (all loss of hope set aside) of this genuine subtlety]/>.

But, granting that, let us return to the main point. (fol.16v) Certainly a twofold difference inheres in the intermingled spirit, both manifestations of which relate to continuity - namely, one of fragmentation, the other <of inequality> or unevenness. For instance, we find some bodies where the spirits are more fragmented, and split up in very small portions. But we find other bodies where the spirits dwell more roomily, and in larger portions. On the other hand, bodies are found in which the spirits are diffused more evenly; and yet others where they are dispersed and situated less evenly. And here we have come to the end of our account of that great difference of the spirit in things, a difference which relates to so many things < - namely, that difference> which is derived from the continuity of the spirit.

There follows another no less important difference of the spirit of things, a difference which derives from the spirit's very substance, temperament, and strength. For in bodies we find spirits which are more biting, lively, and robust. But we find others which are duller and weaker. To speak more plainly, some spirits are more like the substance of air, others more like the substance of flame. For all spirit of

aura conflata ex substantia aerea et flammea; atque quemadmodum in partibus crassioribus <rei> invenitur semper <pars> aquea <sive cruda>, et <pars oleosa sive pinguis> (59). Ita etiam in spiritu invenitur quiddam proportionatum ad utraque. Eadem enim est ratio spiritus et fomitis sui. <Quin etiam utroque genere spirituum tam <naturae> aereorum quam igneae, magna invenitur diversitas et gradus insignes quoad raritatem et sublimationem cum alii sint magis rapidi et tanquam aetherei, alii vero densi et magis affines corporis tangibilis>.

Suscipiunt <etiam> spiritus differentias roboris et vigoris non solum ex originibus suis, sed ex iis quae superveniunt. Omnis enim spiritus intenditur tribus modis, <videlicet> per calorem, motum, et unionem similis spiritus; remittitur itidem <tribus modis oppositis> ex frigore, quiete, et diminutione quanti sui. </n. Comparatio et commissio inter se secundarum actionum locanda est post differentias et desideria/>. Est et alia intentio impropria per irritationem cum spiritus per circunfusionem et approximationem naturae inimicae seu contrariae incenditur, et huic respondens <alia> remissio impropria cum spiritus admota natura amica et placida demulcetur et sopitur. Atque tales sunt spiritus entium differentiae maxime radicales et primitivae, duae scilicet in genere: ex continuatione <una>, et <ex> ipsa essentia sive constitutione <altera>.

(fol.17r) Quod vero ad ipsa desideria spiritus et actiones fontales, illa tria omnino <esse> reperiuntur. Omnis spiritus triplicem habet appetitum, et secundum <eum> perfungitur et operatur: primus est agitationis, et motus, et fruendi natura sua; secundus multiplicandi sui super aliud; tertius exeundi sive conjungendi se cum cognatis (60).

Itaque spiritus <naturaliter certe se movere, et agitare, et volvere delectatur, sed multo magis>, corpori tangibili et crasso inclusus, irrequiete agit et perpetuo experitur, et sumovere corpus illud crassum nititur, et ab eo perculsus, resilit; et huiusmodi pulsationem sine fine repetit. Atque interim per <huiusmodi pulsationem> corpus illud crassum convellit, et fodicat, et subruit. Atque haec <est> actio illa fontalis prima.

things is a breath compounded of an airy and flamy substance - in just the same way that we always find a watery <or crude> <part>, and <an oily or greasy part> in the grosser parts <of the thing>. Thus, in the spirit we in fact find a certain balance between its two components. It is the same with the spirit and its nursery. <But we find in both classes of spirits, likewise of the fiery and of the airy <nature>, great variety and definite degrees in respect of rarity and sublimation - since some are swifter and (as it were) ethereal, others again denser and more akin to a tangible body>.

<Furthermore>,spirits sustain differences of force and vigour not just by virtue of their origins but of those factors which come into play subsequently; for all spirit is incited in three ways - <namely> by heat, motion, and union with a similar spirit; it is likewise abated <in the three opposite ways>, by cold, rest, and reduction of its bulk. </Note: the comparison and bringing together of the subsidiary operations among themselves should be situated after the differences and desires/>. But there is sometimes an illegitimate increase by irritation when the spirit is inflamed by ambient bodies and the proximity of a hostile or contrary nature; <at other times> and corresponding to this, there is an illegitimate abatement when the spirit is soothed and lulled by a friendly and placid nature drawn near. Such then are the most radical and primitive differences of the spirit of things - differences evidently of two kinds: <the one> deriving from the continuity of the spirit, <the other> from its very essence and constitution.

(fol.17r) However, with regard to the actual desires and original impulses of the spirit, there seem <to be> three of them altogether. All spirit has a threefold appetite, and the spirit acts in accordance with <it>. The first impulse of the spirit is that of agitation, motion and enjoying its own nature; the second, of multiplying itself over something else; the third, of going out and uniting with bodies akin to it.

Thus the spirit <indeed naturally delights in moving itself, agitating and turning about but much more>, enclosed within a tangible and gross body, it works restlessly, continually makes trials, and is provoked to drive that gross body away; and the spirit, thrown back by it, rebounds and endlessly repeats this kind of assault. But meanwhile it rends, digs into, and breaks down the gross body <by onslaught of this kind>. This then <is> the first original impulse.

Idem spiritus, <secundum copiam quam habet, alia depascit et appetit, ut inde se conservet, et augeat, et propterea> si datur ubi concluditur aliquid proportionatum unde ille se superfundere et generare possit, in hoc praecipue occupatur, <et> illud corpus <aut partes rei magis idoneas> digerit, et conficit, et in se vertit, et in hunc modum se multiplicat,et latius perfruitur. Atque huiusmodi est actio secunda (61).

<Neque minus> ille ipse spiritus, si admoneatur spiritus similis in proximo, aut massa, <aut regio> cognatorum et connaturalium (qualis est aer praesertim ad vegetabilia, tanto magis si radiis solis aut aliter incalverit) ad se uniendum et conjungendum cum iis conspirat et properat.

</[4. frena]/>. Frenatur autem desiderium exeundi tribus modis: claustris rei, mora liberti, et aliud agendo. Neque enim propter desiderium exeundi sustinet spiritus se frangi et minui nimis, sed plane istam scissionem sui, et subtilizationem, et angustias exhorret. Quemadmodum enim aqua non se effundit per rimas aut foramina subtiliora, ita nec aer nec spiritus, habita <semper> ratione subtilitatis entis ad subtilitatem pori. Itaque si partes rei crassiores compactae et unitae fuerint, cõmprimunt <illi> spiritum et retrovertunt (62). Rursus si partes rei crassiores amicae et cognatae spiritui fuerint, detinetur spiritus facile et evocationem ab externis <magnopere> non <sequitur>. Multo magis si tales sint partes crassiores ut illas spiritus commode subigere et in se vertere atque inde se multiplicare possit (quae est actio illa fontalis secunda), tum plane spiritus illud potius agit et evocationem ab externis fastidit et odit. Atque de natura spiritus entium haec dicta sint.

At altera natura partium crassiorum suscipit differentias potissimum quatuor: videlicet, densi et rari; consistentis et liquidi; crudi <et> pinguis; similaris, dissimilaris et organici. Densum autem proprie accipitur quod sub eodem spatio sive dimenso plus continet materiae, sive illud <sit> consistens sive liquidum; rarum quod minus. <Id quod pondere

This same spirit, <according to the resources available to it, consumes and assails other substances, thereby to maintain and increase itself: and therefore> if it is placed where some suitable substance is enclosed whence it can spread out and propagate itself, it is busied chiefly with this task, <and> arranges and elaborates that substance <or the more susceptible parts of the thing>, and turns it into itself; and in this manner it multiplies itself and operates more widely. Of this kind, then, is the second impulse.

The spirit itself conspires and hastens <no less> to unite and conjoin itself with bodies akin to it if a similar spirit or the mass <or region> of kindred or connatural bodies close at hand, (such as is air, especially in relation to vegetable substances - the more so if the air has grown warm in the sun's rays or some other manner), be incited (24).

</[4 curbs]/>. But the urge to escape is curbed in three ways: by the confines of the object, postponement of freedom, or because the spirit is otherwise occupied. For on account of the desire to escape, the spirit will not suffer itself to be divided or broken up into very small portions, but clearly shrinks from this sundering of itself, and from both subtilization and confined spaces. For just as water does not empty itself through cracks or holes which are too small, so neither will air or spirit - depending <always> on the subtlety of the substance in relation to the subtlety of the pores. Therefore if the grosser parts of an object have been compacted and united, they confine the spirit <to the object> and turn it back. If, on the other hand, the parts are friendly and akin to the spirit, the spirit is easily detained and does not <respond> <very much> to the solicitation of external bodies. The lack of response is the greater if the grosser parts are such that the spirit is able to tame and turn them into itself conveniently, and thereupon multiply itself (which is the second original impulse), for then the spirit rather does that, and disdains and rejects the summons of external bodies. And these points have been made about the spirit of things.

By contrast the other nature, the nature of the grosser parts, sustains four differences especially - namely, of dense and rare; solid and liquid; crude <and> fat; similar and dissimilar or organic. Now a dense body is properly understood as that which contains more matter in the same space or dimension (whether that body <be> solid or liquid); a rare body as that which contains less. <The question of

praecipue examinatur>. Neque enim scholarum more accipimus materiam pro re abstracta aut potentiali, sed vero ente cuius maius vel minus quantum possit asseri de quapiam <re etiam> usque ad calculos (63).

Consistens autem corpus, hic apud nos in ista superficie et incrustatione terrae (64), spiritum habet <aut> magis jejunum aut magis inaequaliter perfusum; quod vero spiritum habet <uberiorem et> magis ex aequo fusum fluit (65).

At de crudo et pingui, sunt illa duo primae corporum texturae et maximae rerum familiae [aperiuntur usque ad coelum. Habentur enim ordines illae primum ordinis], eorumque judicium proprie capitur ex illo quod inflammatur vel non. Nam tertium illud, (fol.17v) quod satis ignoranter addunt chimistae de sale, compositum quiddam plane est ex duobus reliquis. Omnis enim sal habet partes quae ignem concipiunt, et partes quae ignem exhorrent et fugiunt unde etiam rudimentum vitae est. Omnis enim aura vitae consistit ex spiritu aereo et igneo (66).

At similaris et dissimilaris [et organici] natura manifesta est notitie quandoque obscura. Sunt enim corpora quae bene unita et similaria apparent nec tamen sunt. Neque reperi<-re est> fere corpora similaria praeter aquam communem, et quae per ignem separata sunt, et rerum exudationes quae et ipsae sunt <tanquam> naturales percolationes et separationes qualia sunt gummi et similia. Partes vero similares (quas vocant) vegetabilium et animalium interius valde dissimilares sunt et veluti compositae, et decompositae, et multipliciter compositae. Totum autem ipsorum plane organicum est et figuratum et integrale quod terminus ultimus dissimilaritatis <et quasi machina quaedam> est (67). Atque huiusmodi videntur differentiae praecipuae <quoad naturae> partium entis crassiorum.

At desideria et appetitus partium crassiorum atque actiones fontales eius naturae, quinque sunt maxime notatum dignae: statio, latio ad homogeniam, fuga vacui, fuga contrarii, fuga torturae.

Itaque omne ens tangibile et crassum habet innatum torporem, et exhorret motum localem (praeter eum <qui> fertur ad massam magnam connaturalitatis suae qui vulgo dicitur motus gravitatis vel ad centrum), adeo ut licet ens illud ex

weight is the essential point>. For we do not understand matter in the fashion of the schools as something abstract or potential but in fact as a real thing whose bulk can be determined in the case of any <object>, be it greater or smaller, as far <indeed> as calculations are concerned.

On the other hand, a solid body on the surface and crust of the earth here with us has a spirit <either> more meagre or more unevenly intermingled; but matter that has a spirit <more plentiful and> more evenly interfused flows.

But as for crude and fat, they are the two primary textures of bodies, and the greatest families of things [and are evident all the way to the heavens; for those two series are considered, in the first place, of the order], and the distinction between the two of them is properly derived from that which is inflamed and that which is not. As for that third thing (fol.17v) which the chemists add ignorantly enough because of salt, it is plainly a compound of the other two. For all salt has parts which conceive flame, and parts which shrink and fly from it - whence it is also a principle of life; for all breath of life consists of airy and fiery spirit.

But the nature of similar and dissimilar [or organic] is apparent from evidence at one time obscure. For there are bodies which seem to be well united and similar but which are nevertheless not so. One <does> not usually find similar bodies - apart from common water, things which have been separated by fire, and the exudations of things (gums and the like are of this kind) which are themselves <like> natural percolations and separations. In fact the similar parts (as they call them) of vegetables and animals are markedly dissimilar inside and, as it were, composed, decomposed, and composed in various ways. Moreover every one of them is obviously organic, figured, and integral (which is the ultimate limit of dissimilarity), <and like some machine>. And such seem to be the principal differences <with respect to the nature> of the grosser parts of the thing.

As for the desires and appetites of the grosser parts, and the primary impulses of the gross nature, five are most worthy of note: rest, motion to a homogeneous substance, avoidance of a vacuum, avoidance of a contrary body, and avoidance of torture.

Thus all tangible and gross matter has an innate sluggishness and shrinks from local motion - beyond that <which> is directed towards the great mass of its kindred substances which is commonly called motion of gravity or to

heterogeneis plane constet, neque destituatur prorsus desiderio in partibus suis ut illae coeunt ad similia sive homogenea. Tamen tam ignarum illud reperitur desiderium ut, si corpus fuit paulo compactius, facilius patiantur (fol.18r) partes suae morari inter heterogenea quam tolerare motum localem ad expediendum se versus homgeniam. Quod si spiritu turgeant, aut corpus ipsum fuerit laxius (quod fit <plerumque> in liquoribus), aut occasionem nanciscantur quod spiritus <naturam> illam crassam aperiat et stimulet <et torporem illius nonnihil solvat>, tum demum coeunt singulae partes ad proprios fluores; quae tamen ipsa res patitur exceptionem, videlicet si spiritus sit adeo fortis ut strenuus ut compellat partes <rei> manere et se congerere non in eam posituram quae ipsis partibus est maxime in desideriis sed in ea quae spiritui est maxime accommodata (68).

Atque statione naturae crassae et latione ad homogeniam haec dicta sunt. Quod vero ad fugam vacui attinet (ut vulgo loquuntur), vel potius abruptionis tactus, id eiusmodi est postquam spiritus inclusus tolli et rapi coeperit ac plane evolare, qui ipse spatium nonnullum in corpore occupaverat, deest (nisi in corpore <quod alitur>) quod succedere possit; unde relinquitur ut partes rei crassiores se cogant in angustius ut spatium desertum impleant (69).

At fuga illa contrarii talis est: postquam partes crassiores ponuntur in necessitate ut a spiritu conficiantur et ei aliquid de suo largiantur quod vertatur ita ut plane jacturam naturae suae faciant, id quod non libenter faciunt sed ex praedominantia. Ipsae interim sibi non desunt sed, ut constantius naturam suam tueri possint, atque minus opprimi et infestari, neque omnino immutari et destrui, quicquid ex illis immutatum non est summo conatu vires colligit ad huiusmodi vim inimicam propulsendam - unde fit ut partes se constipent et condensent, et ordines suos (ut fit in bello) arctent (70).

Atque de postrema illa actione fontali naturae crassae, manifestissimum est corpus crassum pressurae et tensurae esse

the centre. It shrinks to such an extent that, even if that tangible matter consists of heterogeneous parts, it is not absolutely deserted by the desire, inherent in its parts, to combine with similar or homogeneous substances. Nevertheless, this desire is found to be so obscure that, if the body be a little more compact, its parts more easily suffer themselves (fol.18r) to remain among heterogeneous substances than to undergo local motion by making their way towards homogeneous matter. But if they swell with spirit, or if the body itself is looser (which <commonly> happens in liquids), or if they find an opportunity for the spirit to open and incite the gross <nature> <and break down its sluggishness somewhat>, then at last the individual parts collect together according to their proper fluids. However, this proposition is itself subject to qualification - namely whenever the spirit is strong and vigorous enough to force the parts to stay put and collect themselves together in that configuration which is most convenient to the spirit, and not in the one most desired by the parts themselves.

Now these points have been made about the immobility of the gross nature and motion towards homogeneous matter. But, in relation to avoidance of a vacuum (as they commonly call it), or rather interruption of contact, the key point is that after the imprisoned spirit (which had itself taken up some space in the body) has begun to be abducted and carried off, and even to escape altogether, there is nothing available <except in a body which is nourished>, which can take its place - whence it remains for the grosser parts of the object to draw themselves together more closely to fill up the empty space.

But avoidance of a contrary body is of this sort: when the grosser parts are reduced to the straits of being consumed by the spirit, and of surrendering something of themselves to it which is converted in such a way that they suffer diminution of their nature, they do not put up with that willingly but because of superior force. In the meantime they do not neglect their own interests but, so that they can the more stoutly defend their own nature, be less oppressed, troubled, and not entirely altered and destroyed, whatever has remained unaltered gathers its strength to repel a hostile force of this kind with a supreme effort - whence it happens that the parts draw themselves together, condense, and (as happens in battle) close their ranks.

Now in connexion with the final primary impulse of the gross nature, it is perfectly clear that a gross body

impatiens <sed mensuram suam sive exporrectionem naturalem servare capit> nisi id sensim fiat et detur tempus, aut etiam modis ad hoc propriis invitetur ad se recipiendum in angustius aut ad se dilatandum. Atque quinque istas actiones fontales naturae crassioris ita explicatae a nobis sunt cum motus ipsos clandestinos veluti oculis hominum subjicerimus.

Veniendum itaque iam ad circunfusa sive externa quae quatuor inveniuntur: corpus approximatum; calor et frigus; agitatio et quies; et vices, hoc est reliquorum trium <externorum> constantia, aut alterationes <sive> immutationes. Alia enim rerum <consistentium> dissolutio fit in aere, alia in aqua, alia foret in oleo, alia in cera, alia in arena, alia in cinere, alia si circundarentur plumbo aut argento vivo et sit de coeteris, alia rursus ubi corpora ita locantur ut agitentur, alia vero ubi maneant immota et quiescant, alia in calido, alia in frigido, alia in clauso, alia in aperto, alia si adsint capsulae quaedam et <munimenta>, alia si exponantur nuda, alia cum circunfusa eadem maneant aut in eadem temperie et motu, alia cum subinde mutentur et alternentur (71).

Operantur autem circunfusa duabus modis, videlicet <cum> actiones spiritus et partium (fol.18v) rei crassiorum <juvant aut impediunt>, aut etiam cum ipsa in spiritus et partes vicissim <agunt>, et suam naturam iis imprimunt et communicant. Praecipue autem actiones corporis approximati sunt quod rem aut in substantiam <ipsa rei> attenuent, aut inspissent, aut poris constringant aut relaxent, aut in clandestinis motibus irritent aut demulceant, aut aliquod ex substantia rei alliciant et exugant, aut aliquod ex substantia sui rei indant aut imprimant. Etiam illud praecipue notandum utrum externa collata ad rem sint magis valentia et praedominantia, an potius inferiora et morigera; atque etiam an magis conveniant cum spiritu rei aut cum partibus rei crassioribus; atque insuper cum et spiritum ipsum, multo magis partes crassiores, compositas esse <posuerimus>, videndum imprimis ad quam partem sive homogeniam externa tanquam auxiliares copiae accedant (72).

resents compression and stretching, <but undertakes to preserve its own size or natural dimension> unless it is done gradually and time is given to it or unless, furthermore, the body is prompted by its own means to retreat into a more confined space or to dilate itself. And so, seeing that we were placing the secret motions themselves as if before the eyes of men, we have thus explained those five primary impulses of the grosser nature.

We now come therefore to ambient or external factors which are found to be four in number: a body brought near; heat and cold; agitation and rest; and the vicissitudes of things, i.e. the invariability, or variability <or> alterations of the other three <external factors>. For one sort of dissolution of <solid> bodies happens in air, another in water, another occurs in oil, another in wax, another in sand, another in ash, another if the bodies are surrounded by lead or mercury, and perhaps by other substances, another again where bodies are so placed that they may be agitated, another indeed where they stay motionless and keep still. Another kind of dissolution occurs in heat, another in cold, another under cover, another in the open, another if casings or <means of protection> are near at hand, another if bodies are left unprotected, another when the ambient influences remain the same or in the same condition and motion, another when they are changed and altered repeatedly.

However, ambient factors work in two ways, namely <when> <they help or hinder> the operations of the spirit or the grosser parts of the thing, (fol.18v) or when indeed the ambient factors themselves <work> on the spirits and parts in turn, and stamp and impress their nature upon them. But the operations of a body brought near consist chiefly in what may either attenuate or thicken a thing in its <very substance>, contract or relax it in respect of its pores, incite or pacify it in its hidden motions, or entice and suck something out of the substance of the thing, or set or impress something of its own substance upon it. Furthermore it should be noted particularly whether the external influences associated with an object are more powerful and predominant or more weak and obedient, or whether they are more agreeable to the object's spirit or to its grosser parts, But moreover, since <we have laid down> that the very spirit and much more the grosser parts are compound substances, it must be observed especially to which party or homogeneous body the external influences, like auxiliary forces, chiefly incline.

Differentiae autem externorum et circunfusorum magna cum cura sunt inquirendae et pernoscendae quandoquidem nosse naturas et vias spirituum rei <et motus clandestinos> aut partium crassiorum magis judicio satisfaciat quam practicae; remedia autem quae adhiberi possunt ad dissolutionem prohibendam aut remorandam sumenda omnino sunt ab externis. </AA1/> </thes actions folowe those; the next 2 Aphorisms et inanimatorum et partium/>.
(fol.19r: blank)

(fol.19v) (73)

α.+3 [Quo spiritus in corpore comminuitur magis eo corpus exit magis durabile].

β.+4 [Quo spiritus in corpore magis impariter locantur eo acceleratur dissolutio magis].

ϰ.+5 [Spiritus ascititii et leviter haerentes nisi exhalent spiritus innatos corrumpunt et dissolutionem accelerant].

δ.+ Spiritus qui plus habent ex aere citius evolant quam spiritus naturae igneae propter consubstantiale aeris undique circunfusum.

ε.+7 Spiritus aeri et debiles facile a calore dissipantur et a corpore crasso suffocantur.

ζ. Spiritus qui plus habent ex igne a calore fortiore et continuato et ipsi evocantur.

η.+ [Quod fortifiat et intendit actiones spiritus, id proprie accelerat dissolutionem rei; (de inanimatis)].

θ. Irritatio spiritus per circunfusum intendit actiones spiritus interius, sed minime desiderium exeundi (74).

κ. + [Motus spiritus, licet sit ex fonte substantiae suae, tamen modificatur a consuetudine, et motus quibus assuevit etiam retinet et experitur postquam defecerint organa].

λ.+8 [Spiritus postquam perfecerit opus suum minus est molestus et praedatorius quam in processu].

μ. [Spiritus appetitus primus et potior est fruendi natura sua <et perferendi si datur>; secundus et minor se <servandi et> multiplicandi; tertius se uniandi].

ν. [Omnis motus spiritus est tanquam ad circunferentiam et circunfusa].

ο.9+ [Spiritus non facile sustinet fractionem aut comminutionem sui nisi analogam].

Again, the differences of external and ambient factors should be investigated and examined with great care seeing that knowing the natures and ways <and hidden motions> of an object's spirits and grosser parts gives more satisfaction to the contemplative than to the practical faculty; but on the other hand remedies which can be applied for arresting or delaying dissolution should in general be derived from external factors. </These actions follow those; the next 2 Aphorisms both of inanimate bodies and parts/>.
(fol.19r: blank)

(fol.19v)
α.+3 [The more the spirit in the body is split up, the more durable does the body turn out].
β.+4 [The more unevenly the spirits in the body are distributed, the more is dissolution accelerated].
.+5 [Unless they exhale, extrinsic and lightly adhering spirits corrupt the innate spirits, and hasten dissolution].
δ.+ Spirits which contain a lot of air in their substance escape more quickly than spirits of a fiery nature by reason of the consubstantial body of air completely surrounding it.
ε.+7 Airy and feeble spirits are more easily dissipated by heat, and stifled by a gross body.
z. Spirits of a more fiery nature are themselves drawn out by a stronger and continued heat.
η.+ [That which strengthens and incites the spirit's actions hastens the object's dissolution particularly; (in the case of inanimate bodies)].
θ Irritation of the spirit by an ambient influence incites the spirit's actions within but less so the desire to sally forth.
κ. + [Although it is away from the source of its substance, the spirit's motion is nevertheless modified by habit, and the spirit even retains the motions to which it is accustomed and makes trials with them after the organs have failed].
λ.+8 [When the spirit has completed its work, it is less troublesome and rapacious than it was while doing it].
μ. [The first and stronger appetite of the spirit is to enjoy its nature <and fulfil itself if it is allowed>; the second and lesser, to <preserve and> multiply itself; the third, to unite itself].
ν. [All motion of the spirit is, as it were, to the circumference and ambient substances].
ο.9+ [The spirit does not suffer splitting or division of itself except in appropriate circumstances].

π.+ 9 [Spiritus libenter moratur si partes exteriores fuerint aptae ad leniendum spiritum, sed non ad propagandum].
ρ. [Spiritus aereus citius evolat, at spiritus igneus citius suffocatur].
σ. Spiritus igneus in materia aquea, aut aqueus in materia oleosa accelerant dissolutionem.

(fol.20r) (75)
+ [Quo spiritus in corpore comminuitur magis eo corpus exit magis durabile].
+ [Quo spiritus in corpore magis impariter locantur eo acceleratur dissolutio magis].
+ [Spiritus adscititii et leviter haerentes nisi exhalent spiritus innatos corrumpunt et dissolutionem accelerant].
[Spiritus postquam perfecerit opus suum minus est molestus et praedatorius quam ante maturitatem].
+ [Consuetudo valet in spiritu et quibus motibus spiritus consuescit eosdem retinet, et experitur licet instrumenta deficiant].
[Spiritus emissus corpus <desiccat> et indurat, detentus colliquat et intenerat] (76).
[Abscedente spiritu in corpore consistenti contrahunt se partes localiter, in liquido verò separant se et coeunt secundum homogeniam] (77).
[Spiritus detentus in corpore consistente intenerat, in liquido commiscet, in sequaci vivificat] (78).
Spiritus excitatus <et auctus> calefacit; suffocatus et minutus infrigidat.
Spiritus compressus absque suffocatione calefacit; liberatus et dilatus absque excitatione infrigidat.
[Spiritus torporem et congestationem partium crassiorum solvit et eas ad homogeniam praeparat].
[Ubi partes crassiores praedominantur spiritui, in iis spiritus additus homogeniam inducit solvendo torporem].
[Ubi spiritus praedominantur partibus, in iis spiritus ejectus inducit homogeniam, sublata vi quae eas in ordinem redigebat].

Omnis assimilatio quae est alimentatio fit mediante spiritu; tantus enim est torpor partium crassiorum ut non generaturae fuissent sibi simile nisi a spiritu aperirentur et stimularentur. Videturque eadem ratio inducendi homogeniam et assimilationem cum <utraque> sit proprium opus partium et

π.+ 9 [The spirit is happy to stay put if the outer parts are suitable for pacifying the spirit but not for increasing it].
ρ. [Airy spirit escapes more quickly, but fiery spirit is more quickly stifled].
σ. A fiery spirit in a watery substance or a watery spirit in an oily substance accelerate dissolution.

(fol.20r)
+ [The more the spirit in the body is split up, the more durable does the body turn out].
+ [The more unevenly the spirits in the body are distributed, the more is dissolution accelerated].
+ [Unless they exhale, extrinsic and lightly adhering spirits corrupt the innate spirits, and hasten dissolution].
[When the spirit has completed its work, it is less troublesome and rapacious than it was before completion].
+ [Habit is powerful in the spirit, and the spirit retains the motions to which it is accustomed, and makes trials with them after the organs have failed].
[Spirit emitted <dries up> and hardens the body, spirit held back liquefies and softens it].
[When the spirit has gone away, the parts in a solid body draw themselves together locally, but in a liquid they separate and come together each to its own kind].(25).
[Spirit trapped in a solid body hardens it; in a liquid, it mixes it together; in a sticky substance, it vivifies it].
A vigorous <and abundant> spirit heats things up; one that is stifled and meagre makes them cold.
Spirit compressed but not smothered heats things up; spirit freed and dilated without being aroused cools them.
[Spirit breaks down the sluggishness and congestion of the grosser parts and makes them ready to come together each to its own kind].
[In bodies where the grosser parts hold sway over the spirit, added spirit stimulates the parts to come together each to its own kind by dispelling their sluggishness].
[In bodies where the spirit holds sway over the parts, spirit expelled stimulates the parts to come together each to its own kind, the force having been removed which was keeping them in order].

All assimilation which is alimentation happens through the mediation of spirit; for the sluggishness of the grosser parts is so great that they would not create material similar to themselves unless they were opened up and stimulated by the spirit. And the same seems to be the cause that induces the parts to come together according to their kinds, and assimilation - although <in both> it is the proper work of the

spiritus tantum per accidens. Videndum etiam, praeter aperturam et discussionem torporis, omnis spiritus sit vehiculi loco ad perferenda desideria partium crassiorum (79).

(fol.20v) (80) Aphoris. de inanimatis.
1. Omnis spiritus in ipso motu suo, praeter </Ad./> propagationem naturae suae et evolationem ad cognata, fertur ad circunferentiam et se dilatandum.
[2.] [Spiritus ex approximatione et circunfusione naturae contrariae irritatur magis quam cohibetur si ipse fuerit in aliquo vigore].
[3.] Spiritus occupatus circa sui multiplicationem non facile sub id tempus exitum molitur.
[4.] 2. Spiritus bono suo et natura sua impense fruens non admodum vertit se ad multiplicationem sui.

(fol.21r) </Ad./>. Neque tamen haec nos tanquam experimento prorsus probata proponimus, sed tanquam firmioribus <certe> et magis in ipsa experientia fundatis rationibus, quam artes vulgares advocare solent innixa. Nos enim semina maximarum rerum atque operum spargimus in tempora et satis habemus si initiis cogitationum non desumus (81).

</BB2/>. </desc/>. [Neque vero nimium <cuiquam> videri debet <si> in explicatione dissolutionum circa inanimata <consistentia> tantum operae ponimus <propterea quod eadem omnia> in rebus animatis insunt, <ac multo magis quam in illis ipsis praecipue> causa mortis atque interitus animalium <invenitur>. Spiritus enim animalium natura reparabilis est ut flamma, quin etiam sanguis, humores non difficile reparantur. At partes <praecipue> exsangues, quales sunt nervi, membranae, tunicae, ossa, et similia (82), postquam mollitiem suam et lentorem et succulentiam exuerint, aegre trahuntur retro <sed sensim ad atrophiam vergunt>; <ex quo illud evenit ut non multo post spiritus ipse>, quo ad se reparandum multa praeparatione et ministerio eget, facta officina sive fornace suo multo quam a principio improbiore, non inveniat amplius commoditatem se bene reparandi - unde et ipse sensim minor et exilior evadit. <Tum vero> omnia relabi et retro ferri incipiunt et tandem corruunt].

parts and of the spirit only by accident. It also seems that, in addition to the opening up and dispersion of sluggishness, all spirit acts as a vehicle for carrying out the wishes of the grosser parts.

(fol.20v) Aphorisms concerning inanimate bodies.

1. </Add./> In addition to propagation of its nature and flight to kindred substances, all spirit in its proper motion is directed to the circumference and to dilating itself.

[2.] Spirit, if it be in some strength, is more irritated than repressed by approach and encirclement by a contrary nature].

[3.] Spirit occupied with its multiplication does not willingly try to escape during that time.

[4.] 2. Spirit eagerly delighting in its own wellbeing and nature does not give itself entirely to multiplying itself.

(fol.21r) </Add./> Nevertheless we do not report these as propositions absolutely verified by experiment but as propositions supported by reasons grounded on experience itself, and <assuredly> more convincing than those that the ordinary arts are accustomed to summon to their aid. For we scatter the seeds of very great benefits and works for the future, and deem it sufficient if we be not absent from the birth of these projects.

</copied out/>. [But it ought not to seem too much <to anyone> <if> in the explanation of dissolution we take pains only about inanimate <solid> bodies <because all these same phenomena> are present in animate beings; and indeed the cause <in particular> of the death and destruction of animals <is found> <much more in inanimate bodies than in those living beings themselves> (26). For the spirit of animals is a reparable nature as is flame; and even the blood and humours are repaired without difficulty. But the bloodless parts <principally> - as are nerves, membranes, tunicles, bones, and the like - are scarcely restored once they have lost their flexibility, softness, and juiciness <but they gradually waste away>. <A result of this is that not long afterwards the spirit itself>, having made its workshop or furnace much worse than in the beginning, lacks much aptitude (27) and diligence for restoring itself, and may not find further resources for repairing itself well - whence the spirit itself gradually becomes more feeble and weak. <Then in truth> all things start to relapse and to be set back, and at length they break down].

</CC1/> (83).
(fol.21v: blank)

(fol.22r) (84) Aphorismi de dissolutione rerum
quae fit per aetatem in inanimatis et consistentibus.

Aphorismus 1

</descr./> [Omne ens tangibile hic in superficie et extimis terrae habet spiritum corpore crassiore contectum; neque ullum est corpus tangibile nobis notum quod non consistat ex duplici natura, spiritu scilicet et materia crassa.

Explicatio Aphorismi

In superficie terrae et incrustatione illa exteriore, quae certe non multum producitur in profundum, in quo spatio pulchrae illae officinae animalium, plantarum, et mineralium suas exhibent industrias (85), omne ens tangibile ex perpetua rarefactione et subactione coelestium biforme efficitur et duplicis essentiae <siquidem>, praeter materiam crassam quam sumit a terra, habet a coelestibus, non per infusionem aut inditionem sed per concoctionem et attenuationem, portiones pneumaticas (86) adeo ut reperiantur <profecto apud> nos corpora pneumatica fere sincera <quae parum aut nihil habent e crasso>, qualia sunt aer et flamma (87), sed e contra nullum prorsus reperiatur corpus ex crassis et tangibilibus sincerum sed quod habeat inclusum et commistum aliquod notabile ex pneumatico.

Hoc quale sit volumus distincte et perspicue proponere ne homines speculationibus suis assueti atque ex illis depravato et alienato intellectu aberrent. Primo non intelligimus cavitates et vacuitates in rebus aut spatia, sed plane corpus materiatum licet invisile et intactile quod spatia implet. Secundo non intelligimus virtutes, aut energias, aut facultates corporis aspectabilis et tangibilis, sed plane aliud corpus, corpore illo crassiore obductum et obsessum. Tertio nullo modo intelligimus aerem rebus ipsis commistum, sed plane spiritum rei nativum et proprium. Neque enim succus uvae aqua est, sed vinum, liquor nempe ab aqua longe diversus. Simili modo spiritus ille aer non est, sed <spiritus> substantia <scilicet> tenuis longe ab aere communi diversa (88).

(fol.21v: blank)

(fol.22r) </copied out/>. Aphorisms on the dissolution of things which takes place in inanimate and solid bodies with the passage of time.

Aphorism 1

[Every tangible being here within the surface and outer parts of the earth has a spirit hidden in the grosser body; nor is there any tangible body known to us which is not made up of a dual nature, namely of spirit and gross matter .

Explanation of the Aphorism

Within the surface of the earth and its outer crust (which certainly does not extend very far into the depths), in the region where the wonderful workshops of animals, plants and minerals show their industry, every tangible being is made biform or of a dual nature by the perpetual rarefying and subduing influence of the heavenly bodies <since>, in addition to the gross matter which it takes up from the earth, a tangible being has pneumatic parts derived from the heavenly bodies not by infusion or implantation but by elaboration and attenuation - such that <among> us virtually pure pneumatic bodies (such as are air and flame) are <actually> found <which possess little or nothing of the gross nature>. But, by contrast, we find absolutely no body consisting solely of gross and tangible substances but what has something conspicuous of a pneumatic nature enclosed and mixed in with it.

This is a matter such as we wish to lay down distinctly and clearly lest men, accustomed to their speculations, go astray when their intellect has been corrupted and estranged by them. In the first place, we are not concerned with cavities, vacuities, or spaces in bodies, but simply with a corporeal substance (albeit invisible and intangible) which occupies the spaces. In the second, we are not concerned with virtues, activities, or powers of the tangible and visible body, but simply with another body enveloped and invested in the grosser body. In the third place, we are not in any way concerned with air intermingled in the things themselves, but simply with the native and individual spirit of the thing. For the juice of the grape is not water but wine, a liquid very different from water. In the same way, that spirit is not air but a tenuous substance <of spirit> very different <of course> from ordinary air.

Manifestatio autem spiritus illius infinitis modis se exhibet, sed praecipue tribus: <exhalatione>, eruptione, et fluore. [Omnia enim per aetatem (per <occultum> nimirum et lenem <calorem> coelestium) exuunt paulatim spiritum suum. Idem spiritus a calore forti ignis aut subito erumpit, aut si durioribus vinculis detineatur, saltem cogat corpus fluere] e quibus exhalatio aetatis plerumque, eruptio et fluor ignis aut caloris vehementioris apertae sunt. Etenim lenis ille et occultus, et tamen continuatus, <et perpetuo incendens> calor coelestium educit spiritum paulatim et sine sensu. At <idem> spiritus, si excitetur et irritetur <a calore forti ignis>, aut subito erumpit aut, si durioribus vinculis coerceatur, cogit corpus fluere ut in metallis et vitro.

Neque existimet quispiam levi usus contemplatione spiritum de quo loquimur grandioribus rebus inesse [sed in particulis] pusillis minime, aut humidis et succulentis infundi, sed minime <contineri> posse in rebus aridis et exhaustis. Certissimum enim est cinerem et calcem omni pulvere qui ignem passus non sit esse <quiddam> et subtilius et magis destitutum ab omni humore, <quod> tamen ipsum <solvitur> in sales et raros fluores] (89).

(fol.22v: blank)

(fol.23r) Aphorismus 6

Spiritus acris et mobilis accelerat dissolutionem rei, at placidus et hebes eandem trahit in longum.

Explicatio Aphorismi [7] 6 </8/>

</descr./> Operationes et differentiae spiritus quatenus ad depredationem et consumptionem partium optime cernuntur in flammis. In illis enim ea sunt manifesta et notiora quae in spiritibus sunt occulta et clandestina. <Inter flammas autem eae quae sunt> vivaces et acres <tanto> magis si fuerint agitatae et turbidae sunt maxime consumptivae. Etiam venti mordaces et pungentes, quales sunt orientales et Martiae apud nos, lambunt humida et desiccant maxime (90). Etiam aromata et huiusmodi acria citius et virtute evanescunt et partibus solvuntur quam pares consistentiae ubi spiritus est sedatior. In plantis autem maxime vegeta, et quae celerius proveniunt et exurgunt, minoris sunt durationis.

However, the spirit's presence shows itself in a multitude of ways - but principally in three; <in exhalation>, eruption, and in fluidity. [For all things gradually divest themselves, over a period of time, of their spirit through the truly <hidden> and gentle <heat> of the heavenly bodies. The same spirit provoked by the strong heat of fire either bursts out suddenly or, if it be restrained by sterner bonds, at least forces the body to melt] - by which phenomena exhalation with age, and eruption and fluidity with fire and stronger heat are very often disclosed. For that gentle, hidden, and yet persistent <and constantly burning> heat of the heavenly bodies gradually and insensibly draws out the spirit. But <the same> spirit, if it be excited and irritated <by the stronger heat of fire>, either bursts out suddenly or, if it be confined by sterner bonds, forces the body to melt - as in metals and glass.

Nor should anyone (from reasoning of scant value) conclude that the spirit we speak of is confined to larger objects [but to particles] but to small ones hardly at all, nor that it is diffused in moist and juicy ones but can hardly <be contained> at all in dry and exhausted bodies. For it is most certain that ash and quicklime are <a thing> both more subtle and destitute of all moisture, (<which thing> <is> nevertheless itself <dissolved> in salts), than any powder which has not endured fire].
(fol.22v: blank)

(fol.23r) Aphorism 6

A sharp and mobile spirit hastens the dissolution of an object, but a mild and weak one draws out the process for a long time.

</copied out/>. Explanation of Aphorism [7]6/☉/

The operations and differences of the spirit as far as the plundering and consumption of the parts are concerned are seen to best advantage in flames. For those effects which are hidden and secret in spirits are manifest and obvious in flames. <Moreover, among flames those which are> lively and sharp, <so much the more> if they have been aroused and stirred up, are voracious to the highest degree. Likewise sharp, keen winds such as are the east winds, and March winds here with us lick up moist substances and dry them up exceedingly. Again, aromatic substances and pungent things of that kind both lose their strength and are broken down into their parts more quickly than comparable solid bodies where the spirit is more placid. Again, in plants the most flourishing, and the ones which come out and shoot

Atque inter animalia magis animosa et fervida brevioris sunt aevi (91). Postremo in <regimine hominis> plurima ex laudatis quae videntur facere ad sanitatem, et alacritatem, et functionum roborem et vigorem, ut cibi sanguinem copiosum generantia, et gaudia, et motus multas tum animi tum corporis; utcunque alias juvent tamen de vitae summa detrahunt (92).
(fol.23v: blank)

(fol.24r) Aphorismus 9 </Φ/>

Spiritus non facile sustinet fractionem aut divulsionem sui nisi talem quae sit analoga. Itaque operimenta et exterius compactum arcent dissolutionem rei.

Explicatio Aphorismi 9

</descr./> Cum ex intentione conservationis rerum vel maxime sit ut detineatur spiritus, neque sinatur evolare, necessario videndum quibus modis cohibeatur eius evolatio. Ex quibus se primo offert et exhibet claustrum sive custodia. Etenim omne ens exhorret se ita comminuere et frangere ut nimias angustias subintret et penetret. Omnisque natura corporis habet porum sive meatum analogum. Itaque videmus in aquis fortibus diversi temperamenti alias alia metalla subingredi et aperire, alia minime. Aqua autem rimas tenuiores non penetrat quas tamen aeri perviae esse possint; ac ut verbo dicamus quo corpus est crassius eo ampliorem desiderat meatum (93).

Quin et aer ipse, atque spiritus corporum qui aere est subtilior, et flamma ipsa <qui spiritu est rarior> corpore bene solido et compacto cohibentur. Ludicra enim ascribitur causa, quod in ventosis aut poculo <cum flamma> super aquam inverso, ideo trahi aquam aut carnem quod flamma aut aer calore rarefactus per vitrum aut poculum expiret unde necesse sit aliud corpus trahi et succedere. Certissimum enim est hoc fierti non quod aliquid aeris aut flammae per poculum aut vitrum transeat, sed quod se contrahat corpus flammae in extinctione, et similiter corpus aeris in defervescendo, unde sequitur jactura illa spatii per quod aliud corpus attrahitur non per emissionem sed per contractionem; quod manifestissimum est per aquam frigidam <in> spongiis applicatam ad ventosas,

up more quickly are of shorter duration. Among animals too the more spirited and fiery have shorter lives. Finally, in <man's regimen> there are, among worthwhile things, many which seem to contribute to health, to alacrity, to strength and vigour of the functions (such as nutriment for generating copious blood), and to many pleasures and motions both of the mind as well of the body; yet however these may help in other respects, they nonetheless detract from length of life.
(fol.23v: blank)

(fol.24r) Aphorism 9/θ/

Spirit does not easily endure the splitting or breaking up of its substance unless it is such as is appropriate to it. Thus coverings and compact matter on the outside slow up the dissolution of an object.

Explanation of Aphorism 9

</copied out/>. Since, in conformity with the aim of conserving things, it is of the utmost importance to detain the spirit and stop it escaping, it is necessary to see by what means its escape may be restrained. From among these means confinement or custody displays and exhibits itself at the start. For every being shrinks from so splitting and fragmenting itself that it may enter and penetrate extremely confined spaces. But every kind of body has a pore or channel suitable to it. Thus in the case of strong waters of dissimilar constitution, we see that some enter and open some metals but other metals hardly at all. Likewise water does not enter the finer cracks, cracks which can nevertheless admit air; so that, in a word, we may say that the grosser the body the wider the channel it requires.

But even the very air, the spirit of bodies (which is more subtle than air), and flame itself (<which is rarer than spirit>) are held better by an extremely compact and solid body. For an absurd cause is ascribed to that which takes place when cupping glasses or a bowl are inverted <with flame> over water: that the water or flesh is drawn up because the flame or air, rarefied by heat, exhales through the glass or cup with the result that it is necessary for another body to be drawn in and take its place. For it is absolutely certain that this does not happen because some part of the air or flame passes out through the vessel or glass, but because the body of the flame contracts on extinction and the body of the air in like manner contracts on cooling down - whence follows that loss of volume by which another body is drawn in not by emission but by contraction. This is made very plain by cold water applied

unde illae fortius multo trahunt propter incrassationem <aeris> et contractionem a frigore. Debuerant autem remissius trahite, si per emissionem <aeris>, hoc sequeretur quia per incrassationem <aer> minus habilis redditur ad exeundum. Quin etiam videmus in fornacibus metalla duriora non solvi nisi per flammam flabilem qui ipso motu agatur in poros corporis (94).
(fol.24v: blank)

(fol.25r) (95)
[Omnia hic apud nos in [ista superficie et incrus] in extimis terrae spiritum habent <in> [partibus cont] corpore crassiore contectum [et in] neque ulla est rei in]

Omne ens tangibile hic in superficie et extimis terrae habet spiritum corpore crassiore contectum, [idemque] <atque> inclusum, [et] neque ullum est corpus tangibile quod non consistat ex duplici natura, spiritu et [tangibili] materia crassa.

Explicatio Aphorismi

</descr./> In superficie terrae et incrustatione illa, quae non multum producitur in profundum, in quo spatio pulchrae illae officinae animalium, plantarum, et mineralium suas exhibent industrias, omne ens tangibile ex perpetua rarefactione et subactione coelestium [sincerum non est] <non ... manet sincerum>, sed habet portiones attenuatas et plane versas in spiritum, adeo ut reperiantur <apud nos> corpora pneumatica <fere sincera>, ut aer purus, <quae non aliquod habent ex crasso, sed contra> [sed] nil ex crassis sincerum [quod nil habeat spiritum permistum aliquod] <reperitur quod non habeat aliquod notabile> ex pneumatico.

[Primo vero] Hoc autem quale sit volumus distincte et perspicue proponere ne homines speculationibus suis assueti atque ex illis depravato et alienato intellectu [... sunt] aberrent. Primo [cum agnoscant] non intelligimus cavitates aut vacuitates in rebus [quas vulgus ph] <aut spatia>, sed plane corpus materiatum [sed] licet [pneumaticum] <invisile et intactile> quod spatia implet [et]. Secundo non intelligimus virtutes, aut energias, aut facultates corporis aspectabilis et tangibilis, sed plane aliud corpus corpore illo

<in> sponges to the cupping glasses which causes them to draw much more strongly by virtue of condensation and contraction <of the air> by cold. But if this phenomenon had arisen from emission of air, the glasses should have drawn more gently because <air> is made less fit by condensation for escaping. Indeed, we even see that harder metals are not melted in furnaces except by a windy flame because the flame is forced by its own motion into the pores of the body.
(fol.24v: blank)

(fol.25r) (28)
[All things here with us in [that surface and crust] in the outer parts of the earth have a spirit hidden <in> [hidden in the parts] the grosser body [and in]; nor is there anything of a thing in]

Every tangible being here within the surface and outer parts of the earth has a spirit hidden [and the same] <and> enclosed in the grosser body; [and] nor is there any tangible body which is not made up of a dual nature, of spirit and [tangible] gross matter.

Explanation of the Aphorism

</copied out/>. Within the surface of the earth and its outer crust (which certainly does not extend very far into the depths), in the region where the wonderful workshops of animals, plants and minerals show their industry, every tangible being [is not unmixed] <does not stay ... unmixed> but, by the perpetual rarefying and subduing influence of the heavenly bodies, has attenuated parts plainly turned into spirit - such that <among us> pneumatic bodies are found <virtually unmixed>, as pure air, <which do not possess anything of the gross nature but, on the contrary>, [but] from among gross bodies none <is found> unmixed [which does not have some intermingled spirit] <which does not have something conspicuous> of a pneumatic nature.

[Indeed in the first place] But this is a matter such as we wish to lay down distinctly and clearly lest men, accustomed to their speculations, [are ...] go astray when their intellect has been corrupted and estranged by them. In the first place, [since they know] we are not concerned with cavities or vacuities <or spaces> in bodies [which the common philosopher], but simply with a corporeal substance [but] (albeit [pneumatic] <invisible and intangible>) which occupies the spaces [and]. In the second, we are not concerned with virtues, activities, or powers of the tangible and visible body, but simply with another body contained

crassiore contectum et obsessum. Tertio nullo modo intelligimus aerem rebus ipsis commistum sed [sp] plane spiritum rei nativum et proprium. Neque enim succus uvae [rei] aqua est sed vinum, liquor nempe ab aqua longe diversus. Simili modo spiritus [a] [vini ipsius vel etiam] rei aer non est sed substantia tenuis longe ab aere communi diversa. [Itaque]

Manifestatio autem spiritus infinitis modis se exhibet, sed praecipue tribus: eruptione, exhalatione, et fluore. (fols.25v-26r: blank)

(fol.26v) Aphorismus 2

Spiritus in rebus aut abscissus est, aut ramosus. Ramosus autem aut simpliciter ramosus est, aut ramosus simul et cellulatus. Abscissus <spiritus> est spiritus inanimatorum; <simpliciter> ramosus vegetabilium; ramosus et cellulatus animalium (96).

Explicatio Aphorismi 2

</descr./> Spiritus autem <in> materia crassa inclusus nisi inveniat materiam primo lastam et sequacem (quam efformare et effingere possit), deinde postquam <per huiusmodi materiam> sibi aperuerit quasdam vias et canales <ut deinceps> in iisdem se continuare queat et movere commode, non magna certe edit facinora, sed tantummodo se multiplicare et materiam crassam stimulare et subigere et deinde evolare nititur. Quod si detur copia se sibi continuandi, et per hoc natura sua utendi et fruendi, tum demum se incendit, et se gerit pro potestate sua, unde primo corpus ad integrale figurat et determinat deinde, discutiendo congelationem et torporem materiae crassae <sibi contiguae>, eam excitat ut sui simile generet et adoptet unde sequitur alimentatio modis de quibus postea dicetur (97).

Quod si non tantum diffundere se spiritus possit per canales illos et ramos, sed etiam sedem aliquam et cellam <sibi> parare ubi in quanto aliquo notabili congregari possit, tum vero sequuntur effecta multa nobilia. Primo enim ex agitatione incendit se taliter ut plerumque calor deprehendatur ad tactum; deinde ex regimine spiritus in cella, spiritus in canalibus se comprimit et dilatat unde sequitur pulsus et motus

and invested in the grosser body. In the third place, we are not in any way concerned with air intermingled in the things themselves, but [of the spirit] simply with the native and individual spirit of the thing. For the juice of the grape [of the thing] is not water but wine, a liquid very different from water. In the same way the spirit [from] [of wine itself or even] of the thing is not air but a tenuous substance very different from ordinary air. [Thus]

Moreover the spirit shows its presence in a multitude of ways, but principally in three: in eruption, exhalation, and fluidity.
(fols.25v-26r: blank)

(fol.26v) Aphorism 2

The spirit in things is either cut off or branching. But branching spirit is either simply branching or at once branching and seated in a cell. <Spirit> cut off is the spirit of inanimate beings; <simply> branching, the spirit of vegetable beings; branching and seated in a cell, the spirit of animals.

Explanation of Aphorism 2

</copied out/>. Now unless the spirit enclosed <in> gross matter finds elastic and sticky matter at the outset (which it can shape and fashion) then once it has opened up for itself certain ways or channels <through matter of this kind> <so that> it can <next> join itself up and move conveniently, it certainly does not perform great actions but is only provoked to multiply itself, disturb and subdue the gross matter and then escape. But if it has the resources for joining itself up and through that for exercising and enjoying its own nature, then indeed it kindles and conducts itself according to its capability. The result of this is that it at first fashions and organises the body into an integral form, and then by dispelling the inflexibility and sluggishness of the gross matter <adjoining it>, incites it to generate and annex something akin to itself - whence follows alimentation by means to be discussed hereafter.

But if the spirit is able not only to spread itself through those channels and branches but also to provide a seat or cell <for itself> where it can be gathered in some conspicuous quantity, then indeed much more impressive effects ensue. For, in the first place, it kindles itself by agitation so much that heat is very often perceived by touch; then, by virtue of the influence of the spirit in the cell, the spirit in the channels contracts and dilates

localis. Tertio, ex perceptionibus momentaneis spiritus ramosus, referuntur passiones <eius> ad spiritum congregatum tanquam <ad senatum aut> universitatem, unde sequitur sensus et reliqua quae ex sensu pendent. Materia vero crassa <in contiguo> ita acuitur et excitatur ut non tantum sibi simile aliquatenus generare (quod est actio alimentationis simplex) sed etiam, dotata fastidio nonnullo si quid minus conveniens sit ad assimilandum, illud rejicere et separare et excernere possit (98).

Atque haec sunt vera spiritus opera, a nullo adhuc bene notata, ex quibus verae <eadem> differentiae inanimatorum, vegetabilium, et animalium sumuntur. Isti autem duo aphorismi nil aliud sunt quam fundamenta quaedam jacta <in genere> ad sequentes aphorismos qui <de> dissolutione rerum proprie tractant (99).

(fol.27r) Aphorismus [5]

Spiritus paucus facilius cohibetur, at plenius et tumens accelerat dissolutionem rei.

Explicatio Aphorismi 5

</desc./> Non attenditur magis vigor et qualitas spiritus quam ipsum quantum; utcunque enim <inveniatur in re aliqua> spiritus acris et impetuosus, tamen si parce <rei commisceatur> et in exigua et egena quantitate, debilem praestat actionem. Itaque naturalia corpora <quaeque>, postquam <a> terra et matricibus suis avulsa fuerint et separata, sub ipsam viriditatem suam, in parvo tempore multum immutantur <et desiccantur collata> ad vigorem illum et succulentiam in quibus primo fuerint decerpta aut avulsa; sed paulo post <minus <saltem> et mulctati spiritu>, diu durant quasi in eodem statu absque alteratione manifesta. Quin etiam illa quae citissime spiritu deponant et <propterea> rugosa deveniunt <et addicta> longissime plerumque durant actione scilicet lenta spiritum paucum semper commitante. Itaque in animalibus alimenta quae succum maligne praebent et spiritum servant jejunum et paucum, ut oleia, potus aquae, pisces aridae, et similia <(si coetera competant)>, magis valent ad diuturnitatem vitae quam potus spirituosi, et <cibi> qui generant succum copiosum (100).

itself, and pulse and local motion follows from this. In the third place, by virtue of the momentary reactions of the branching spirit, <its> passions are returned to the collected spirit as if <to a parliament or> university - whence follows sensation, and the rest which depends on sensation. Indeed, gross matter <in the vicinity> is so stimulated and aroused that it is able not only to generate something somewhat like itself (which is the simple action of alimentation) but, endowed with an antipathy towards anything less suitable for assimilation, it is also able to reject, separate, and discharge it.

And these are indeed the true works of the spirit, works accurately observed by no one until now and works from which these <same> true differences of inanimate beings, vegetables, and animals are derived. Moreover, this pair of aphorisms is nothing other than a kind of foundation <in all respects> laid down for the subsequent aphorisms which treat <of> the dissolution of things in the strict sense.

(fol.27r) Aphorism [5]

A meagre spirit is more easily repressed, but a full and swelling one hastens the dissolution of the thing.

Explanation of Aphorism 5

</copied out/>. The vigour and quality of a spirit is no less relevant than its quantity. For whenever a sharp and vigorous spirit <is found in some object>, and if <it is> nevertheless <mixed in with the object> sparingly and in both scanty and meagre quantity, it exhibits a weak action. Thus once they have been torn out and removed <from> the ground and their wombs about the time of their very vigour, <all> natural bodies are greatly altered <and dried up> in a short time <compared> to the vigour and juiciness in which they were first gathered or plucked. But a little later, <<at all events> less tormented by the spirit>, they last a long while as if in the same condition and without manifest change. But even those things which divest themselves of spirit most rapidly, and become wrinkled <and parched> <for that reason>, last for the most part the longest because sluggish action always accompanies a meagre spirit. Thus, in the case of animals, foods which furnish juice grudgingly and keep the spirit meagre and scanty - as oily substances, draughts of water, dried fish, and the like - contribute more <(all other things being equal)> to length of life than do spirituous drinks and <foods> which engender abundant juice.

[Aphorismus 6]

</Ad./> Spiritus qui magis consubstantiales aeri sunt, citius evolant propter aerem cognatum undique circunfusum; at oleum et pinguia <minus> depraedatur aer.

Explicatio Aphorismi 6

Dictum est in aphorismis praecedentibus (101) oleosa magis esse diuturna quam aquea, primo ob subtilem et aequalem comminutionem spiritus; secundo <quia> spiritus familiariter in illis detinetur nec excitatur. Subest et tertia causa non minus quam illae <duae> potens. <Omnia enim> hic apud nos (praeter pisces et subterranea) degunt aut servantur ubi aer circunfunditur. Itaque evolat spiritus non solum ob desiderium suum exeundi, verum etiam plane sollicitatur et evocatur ab aere <tanquam inita conspiratione> unde generatur eius actio in illis quorum spiritus habent consensum cum aere.

(fol.27v) Itaque flores et <fere omne vegetabile <necnon <aquea et> liquores> quippe cum habeant multum ex spiritu aereo>, si diu exponantur <ad aerem> statim odores et <sapores et> vires suas perdunt. At in animalibus quorum substantia est magis oleosa nil periculi est ab aere praesertim simplici et frigido. Quin valet potius ad diuturnitatem vitae vita sub Deo (102), et aere libero. At illis cavendum est ab immolatione nimia et accessione <crebra aut mansione diutina> ad focum, et decubitu nimio in lecto ubi aer clausus inficitur ab exhalatione corporis unde spiritus corporis magis elicit et exsoluit, et dissolutionem corporis accelerat.

(fol.28r) (103) [At animatorum, licet sit magna]

</Ad./> Animatorum vero natura est partim communis cum inanimatis, partim propria. Omnia enim quae diximus insunt etiam animatis neque superaddita [vit] <natura> vitalis illas extinguit, sed redigit tantum in ordinem <idque ad tempus>. [Vulgus] [Contemplationes autem] [receptae] [quae receptae sunt [<invaluerunt>] aut ullo modo innotuerunt redditae sunt fere attonitae ex]. Hoc [vero] <ipsum <vero> de quo nunc loquimur> imprimis attendendum et tenendum est. Solent enim homines in viventibus vitales actiones fere solas et per se contemplari <ac si illae omnia traherent et totum corpus vendicent> praesertim in animalibus in quibus <medici et

[Aphorism 6]

</Add./>Spirits which are more closely akin to air escape more quickly because of the kindred air enveloping them on all sides; but air plunders oil and greasy bodies less.

Explanation of Aphorism 6

It has been said in preceding aphorisms that oily bodies are more long-lasting than watery ones - because, in the first place, of the subtle and even distribution of spirit, and <because>, in the second place, the spirit is detained within them on more amicable terms and is not aroused. There remains a third cause no less crucial than the other <two>. For all things here with us (save fish and subterranean bodies) live or are sustained where air is crowded round them. Thus spirit escapes not just because of its own desire to get out but it is, in fact, enticed and drawn out by the air <as by a conspiracy entered into between them>, whence springs the spirit's activity in those bodies whose spirits have sympathy with the air.

(fol.27v) Thus flowers, and <almost every vegetable body, <as well as <watery substances and> liquids>>, lose their smells, <flavours and> powers immediately if they are exposed <to air> for long, <since they certainly contain much of the airy spirit>. But in animals, whose substance is more oily, there is no danger from plain and cold air especially. But living beneath the skies and in the open air rather contributes to longevity. But they have to beware of too much heat and <frequent> excess <or constant staying at home>, proximity to the fire and excessive lying in bed where stuffy air is tainted by bodily exhalation - whence the body's spirit evolves and discharges more, and hastens the dissolution of the body.

(fol.28r) [But of animate beings, though it be great] </Add./> Indeed, the nature of animate beings is partly common to inanimate ones, and partly its own. For the superadded [vital] vital <nature> does not annihilate all those operations which we said are also present in animate bodies, but only reduces them to order, <and that only for a while>. {The vulgar] {But {received] ideas] [which have been received] <[have grown strong]> {or have become by any means known have been relinquished, for the most part confounded by]. This [in fact] <very topic of which we now <in fact> speak> should especially be considered and borne in mind. For men are accustomed to view the vital actions in living things alone and in isolation for the most part, <as much as if those actions influenced all matters and laid claim to the whole body> - especially in the case of animals

[pro] praecipue> anatomistae [et mechanicae], <mechanica> plane <et oculari> subtilitate <et diligentia> freti, omnia ad illas referunt; et in ipsa subtilitate crassi, plane et pingues naturae inquisitores evadunt. Longe enim maior subtilitas est spirituum invisibilium, et <clandestinorum> pororum [partium tangibilium] <in partibus>, et actionum, et functionum [clandestinarum] insensilium quam venarum, et fibrarum, et ramusculorum, et <retium, et> meatuum apparentium, et perforationum, et huiusmodi, <in quibus illi cum perspicatia excutiunt>.

Omne vero vivens <apud nos> patitur tormentum illud Mezentii (104), [ut] ut viva in complexu mortuorum pereant; atque, licet ad tempus natura vitalis <[prae-]gestiat et> praedominetur, tamen non ita multo post affectus partium secundum naturam [so] substantiae et <[de mo] demortuae>, neutiquam secundum natura viventis [re praene] praegravet nisi accuratis remediis altera natura confortetur, altera [debilitetur] <immutetur>. Itaque ante omnia natura utraque in se consideranda est et explicanda, neque (quod in principio diximus) inquisitio quovis modo confundendo.

Habet itaque corpus vivens omnia illa quae diximus de inanimatis, sed habet etiam in proprio spiritum ramosum <sibi continuum> et accensum; [habet alimentationem]; habet <figuram et> integralitatem; <habet alimentationem cum augmento in tempus> quae tria corpus [plant] inanimatum non habet. Haec vero tria omni viventi insunt tam vegetabili quam animanti. Sed habet insuper natura animalis et sensibilis spiritum in cella, motum localem, [et] distributa organa <et> officia, atque excretionem.
(fol.28v: see below)

(fol.29r with interpolation drafted on fol.28v) </Ad./> At animatorum natura est partim communis cum inanimatis, partim propria. Omnia enim quae diximus insunt etiam animatis neque superaddita natura vitalis ea extinguit, sed in ordinem redigit (105). Latent <vero> illae operationes sub actionibus vitalibus ad tempus. Quamdiu enim viventia sunt in augmentis suis, tamdiu victoria est penes actiones vitales; dum vero sunt in statu tanquam ex aequo res transigitur. At in decursu aetatis praegravant operationes substantiae super actiones vitales <nisi accuratis remediis altera natura confortetur,

in respect of which <physicians and, [for] in particular>, anatomists, [and artisans] <simply> by trusting <to mechanical practice>, subtlety <of sight>, and diligence, refer everything to those actions; and the investigators, crude in that very subtlety, become stupid. For far greater is the subtlety of the invisible spirits, of the <hidden> pores [of the tangible parts], <in the parts> and of the [hidden] imperceptible actions and functions than is the subtlety of the veins, and fibres <and> ramusculi, and <networks, and> visible openings and perforations, and such-like, <into which those investigators search with acuteness>.

In fact, every living thing <found among us> suffers the torture of Mezentius - [that] that the living parts perish in the embrace of the dead. Indeed, although the vital nature <[greatly] exults, and> holds sway for a while, the will of the parts nevertheless gains the upper hand not long afterwards, according to the nature of the substance and <the lifeless nature>, and in no wise according to the nature of the living one - unless the former is supported by precise remedies, the latter [is enfeebled] <is altered>. Thus the nature of each should be examined and unravelled in itself first of all; and (as we said at the start) the investigation must not be confused in any way.

Accordingly, a living body has all those properties which we affirmed of inanimate ones, but in its own right it also has branching spirit, <continuous in itself>, (29) and kindled; [it has alimentation]; it has <shape and> internal organisation; <for a time it has alimentation accompanied by growth> - which three attributes [a plant] an inanimate body does not possess. In fact these three attributes inhere in all living beings, vegetable and animal equally. But, in addition, the animal and sensible nature possesses spirit in a cell, local motion, [and] distributed organs <and> functions, and excretion too. (<u>fol.28v</u>: see below)

(<u>fol.29r, with interpolation drafted on fol.28v</u>) </Add./> Indeed, the nature of animate beings is partly common to inanimate ones, and partly its own. For the superadded vital nature does not annihilate all those operations which we said are also present in animate bodies, but only reduces them to order. <In fact>, those operations lie hidden beneath the vital actions for a while. For as long as living things are in their growth, for so long do the vital actions have the upper hand; and so the matter rests, as it were, in the balance while they are in this state. But with the passage of time the operations of the substance gain over the vital actions; <unless the former nature is

altera immutetur>. Itaque omnia viventia patiuntur et subeunt tormenti illud genus Mezentii, ut viva in complexu mortuorum pereant; quocirca paulo diligentius attendendum nec confundenda est inquisitio ut iam a principio dictum est (106).

Nam ut nunc sunt res, consueverunt medici et maxime illi qui in anatomia diligentiam suam ostentant, mechanica et oculari subtilitate freti, actiones vitales solum et per se contemplari atque omnia ad illas referri, ac si illae omnia traherent. Homines in ipsa subtilitate crassi. Longe enim maior subtilitas est experimenti quam sensus (107); longe maior subtilitas spirituum invisibilium, et clandestinorum in partibus pororum, et functionum insensilium (quae omnes demersae in substantiis sunt nec se nisi per effectus noscendae praebent), quam visibilis fabricae venarum, <et> fibrarum, <et> ramusculorum, <et> retium, et meatuum apparentium, et perforationum, et huiusmodi in quibus <anatomistae> cum perspicatia <quadam> excutiunt (108). Quare utraque natura <in> se perpendenda <est> et explicanda.

<[Atque omnis illa dispensatio et administratio de <qua> iam diximus, etiam spiritus illi abscissi <et intermisti> <intelligantur inesse> plane carni, sanguini, membranis, ossibus, atque universae moli partium corporis viventis <dum vivit>. Etiam in illis post mortem supersunt et durant tanquam operationes substantiae inanimatae <et neutiquam viventis>; sed tamen ab actionibus vitalibus dum res in vita sunt, eaedem multum impediuntur et subjugantur. Itaque ulterius de natura viventium quatenus vivant inquirendum]>.

(fol.28v) </Ad./> <Itaque omnia illa quae diximus de corporibus inanimatis <<circa> attenuationem, evolationem, contractionem, coitionem ad homogeniam, et reliquos> intelligantur etiam inesse <et competere> carni, sanguini, membranis, ossibus, atque universae moli corporis viventis etiam dum vivit. <Atque habere <ubique> illa spiritum intermistum et perfusum, qualem eum in inanimatis descripsimus, nisi quod sit paulo magis turgidus et mobilis praeter illum vitalem ramosum et continuum qui est proprius viventium.> Quin etiam

supported by precise remedies, the latter is altered>. Thus all living things suffer and undergo the kind of torment devised by Mezentius, that the living parts perish in the embrace of the dead - on which account the investigation should be directed a little more diligently, and it should not be confused - as has already been said at the beginning.

For, as matters stand at present, the physicians and, above all, those who exhibit their skill in anatomy have been accustomed, by trusting to mechanical practice and subtlety of sight, to view the vital actions alone and in isolation, and to refer everything to them, as much as if those actions influenced all matters. Men are crude in that very subtlety. For the subtlety of experiment is far greater than the subtlety of the senses; and the subtlety of the invisible spirits, of the hidden pores in the parts, and of the imperceptible functions (which are all buried within substances, and do not reveal themselves to the understanding save by their effects) is far greater than the subtlety of the visible fabric of veins, <and> of fibres, <and> ramusculi, <and> networks, and of the visible openings, perforations, and suchlike into which <the anatomists> search with <some> acuteness. And for that reason each of the two natures <should> be examined and unravelled <in> itself.

<[Now all the management and direction of <which> we have spoken already, and also the spirits cut off <and interspersed> <are> clearly <understood to be present> in the flesh, blood, membranes, bones, and the entire mass of a living body's parts <while it lives>. Moreover, these remain in them after death, and persist as operations of the inanimate substance, <and in no wise of a living body>; but while beings are alive, these same operations are nevertheless much obstructed and held in thrall by the vital actions. Thus the nature of living creatures, insofar as they are alive, should be examined further]>.

(fol.28v) </Add./> <Thus all those things which we have spoken of in connexion with inanimate bodies, <<about> attenuation, escape, contraction, attraction to homogeneous matter, and the rest>, are also understood to be present <and to come together> in flesh, blood, membranes, bones, and the entire mass of a living body while it still lives. <But we have explained that, in addition to the branching and continued vital spirit characteristic of living beings, those parts have a spirit <everywhere> intermingled and interfused such as the one in inanimate things, save that it is a little

post mortem <universa illa> natura in cadavere superest et durat; verum illae operationes et actiones mortuales, dum res sunt in vita, ab actionibus vitalibus multum impediuntur et subjugantur. Iam igitur de natura viventium quatenus vivant inquirendum>.

(fol.29r) <Verum> quemadmodum in affectibus inanimatorum eos tantummodum delegimus qui ad dissolutionem et durationem rerum pertinent, similiter et in tractatu animatorum intra illos fines nos continebimus, nec capti rerum singularum amore expatiabimur. Itaque quoad durationem et dissolutionem rerum, duae omnino sunt differentiae et discrimina praecipua inter animata <et inanimata>: una quae dissolutionem accelerat longe magis quam in inanimatis, altera quae eandem arcet atque immortalitatis ipsius quoddam ludibrium est et umbra.

(fol.29v) </Ad./> [Prima ea est quod [omnis] spiritus <[insit] inest> in viventibus non tantum [ramosus et] sibi continuus et ramosus, verum etiam plus minus accensus. Omnis enim spiritus vivens sive vegetabilis sive animans habet [in] nonnihil tanquam e flamma accensa, longe <inter se> dispari gradu sed tamen ex illa natura in genere. Etenim licet [sit spiritus in animantia] vegetabilia ad tactum <humanum> non [sunt] sint calida, tamen procul dubio habent illa nonnullum udi caloris, ut ex omni vegetabili qui [ca] decerptus cum sit viridis et servatur conclusus, [unde] ad manum devenit calidus; atque etiam ex aquis ardentibus et inflammabilibus quae ex omni vegetabili surgunt per distillationem manifestissimum est] (109).

</Ad./> [Quarum prima est accensio spiritus <[atque adeo spiritus ipse accensus]>; secunda alimentatio partium crassiorum. Omnis enim spiritus qui inest in viventibus, sive in vegetabili sive in animanti, accensus est plus minus, et habet nonnihil ex flamma accensa licet gradu accensionis longe dispari]. Atque tamen vegetabile omne ... (qualia sunt flores et folia) plantarum, si decerpatur viride et servetur conclusus, ad manum fit calidus et quandoque flammam concipit. Extrahitur etiam ex illis omnibus aqua ardens et inflammabilis. At animantia etiam ad tactum calida sunt, atque respiratione indigent quae <caloris> est refrigerium (110).

more swollen and mobile>. But really <the whole> nature remains and persists in the corpse after death; yet those inanimate operations and actions are much obstructed and held in thrall by the vital actions while beings are alive. Thus the nature of living creatures, insofar as they are alive, should be examined forthwith>.

(fol.29r) <But> just as we refer only to those matters which relate to the dissolution and persistence of things in the case of inanimate bodies, so in the treatment of animate beings we shall confine ourselves within those limits and, immune to the attractions of extraordinary instances, we shall not wander off the point (30). Thus, as far as the persistence and dissolution of things are concerned, there are in all two things which principally differentiate and distinguish between animate <and inanimate> bodies: the one which hastens dissolution far more in animate than in inanimate bodies; the other which inhibits it, and is a sort of caricature or imperfect copy of immortality (31).

(fol.29v) </Add./> [The first is the one that [all] spirit <[may be present] present> in living things <is> not only [branching and] continuous in itself (32) and branching, but more or less kindled. For every living spirit, either vegetable or sensible, has [in] something as it were of kindled flame, differing greatly in degree <between themselves> but nevertheless of that nature in general. For although [the spirits in animate bodies be] vegetable bodies [are] <may> not <be> hot to <human> touch (33), they nevertheless have, without doubt, some degree of moist heat so that [whence] a perceptible heat comes from every vegetable which has been [plucked] gathered when it is fresh, and kept close; and that, indeed, is also very evident from the burning and inflammable waters which ascend from every vegetable during distillation].

</Add./>[The first of these is the kindling of the spirit <[and even the kindled spirit itself]>; the second, the nourishing of the grosser parts. For all spirit which inheres in living beings, be it in a vegetable or in an animal body, is more or less kindled, and possesses something derived from kindled flame, though greatly differing from it in degree of kindling]. But nevertheless, every vegetable ... of plants (as are flowers and leaves), if it is gathered fresh and kept close, heat is felt by the hand, and the vegetable matter sometimes conceives flame. Moreover, a burning, inflammable water is extracted from all these substances. But animal bodies (34) are also warm to the touch and they need respiration which is a means of mitigating <the heat> (35).

<At> iste spiritus accensus instar flammae mollis, humida, et succum corporis viventis perpetuo depascit et depraedatur unde fit ut nisi succ<edati> alimentum, longe magis acceleretur consumptio et dissolutio in animatis quam in inanimatis. Magis enim durabile est inanimatum <in se> quam animatum absque alimento. Atque haec est differentia illa prima animati erga inanimatum, videlicet <incensio> spiritus quae per se obest durationi rerum non prodest. Secunda vero actio caput <totius negotii> est de qua tractamus: <illa est alimentatio sive> refectio aut reparatio partium crassiorum. In hac igitur inquirenda et explicanda praelucere aliis volumus, remque omnem hominibus sub oculos ponemus (111).
(fol.30r: blank)

(fol.30v) </A./> Omnis spiritus in <natura sua>, praeter duas illas molitiones multiplicandi sui et exeundi ad cognata <ipso motu et agitatione delectatur, qui motus> fertur ad circunferentiam potius quam ad centrum, et ad se dilatandum potius quam constringendum. Itaque difficilis admodum est alimentatio ab externis (112).

Tensura aut pressura praeternaturalis absque appetitu interno spiritui molesta est non minus quam partibus rei crassioribus. Itaque destruit plane actiones spiritus et confundit (113).

Motus spiritus licet sit ex fonte substantiae suae tamen modificatur a consuetudine quae tantum valet ut motus quibus assuevit spiritus etiam retineat et experiatur postquam defecerint organa (114).

Habent motus spiritus, partim ex natura sua partim ex consuetudine cum partibus quibus fuerint inclusi, quosdam periodos. Itaque spiritus postquam perfecerit opus suum minus est praedatorius quam in processu (115).

Spiritus bono suo et natura sua impense perfruens non vertitur admodum ad multiplicationem sui (116).

Spiritus occupatus circa multiplicationem et generationem sui non facile sub id tempus exitum molitur.

<But> this kindled spirit, like a gentle flame, constantly feeds on and plunders the moist parts and juice of a living body whence it happens that, unless alimentation follow, consumption and dissolution are hastened in animate far more than in inanimate beings. For an inanimate body is more durable <in itself> than an animate one without food. Now this is the first distinguishing feature which separates animate from inanimate being - namely <the burning> of the spirit which is in itself hurtful, and not beneficial to the persistence of things. However, the second action is the crux <of the whole business> of which we treat: <that is the alimentation>, or refreshment or restoration of the grosser parts. Thus in the inquiring and explaining of this we wish to light the way for others, and set the whole matter before men's eyes.
(fol.30r: blank)

(fol.30v) </Add./> In addition to those two motions of multiplying itself and going forth to kindred substances, all spirit in <its own nature> <is delighted by that very motion and agitation - a motion which> is directed towards the circumference rather than to the centre, and to dilating rather than contracting itself. Thus alimentation from the outer parts is exceedingly difficult.

Without inward desire, preternatural stretching or compression is no less troublesome to the spirit than to the grosser parts of the object. Thus it obviously destroys and confounds the spirit's operations.

Although it is away from the source of its substance, the spirit's motion is nevertheless modified by habit which has such force that the spirit even retains the motions to which it is accustomed, and makes trials with them after the organs have failed.

Partly through their own nature and partly through familiarity with the parts in which they have been enclosed, the motions of the spirit have certain cycles of activity. Thus when the spirit has completed its work, it is less rapacious than it was while doing it.

Spirit eagerly delighting in its own wellbeing and nature does not entirely give itself to multiplying itself.

Spirit occupied with its multiplication and generation does not willingly try to escape during that time.

Irritatio spiritus per antiperistasin circunfusorum intendit eius actiones ad tempus donec spiritus, lassatus et fractus, succumbat (117).

Irritation of the spirit by the antiperistatic action of ambient influences incites its operations for a while until the spirit, weakened and enfeebled, yields.

Textual notes

Unless otherwise stated, all the interpolations and deletions recorded below were made by Bacon himself. The positions of deletions which occur in the manuscript but not in the transcription have been recorded in this manner, e.g. Page 90: "L.27, after 'solum', '[tenuia]'". This means that on line 27 of the transcription the word 'solum' was followed in the manuscript by the deleted word 'tenuia'. When 'before' occurs instead of 'after' then, of course, the deleted item stood before the 'guide-word'.

Page 82
The title De viis...: the underlining here and elsewhere in the transcription indicates the bold italics used by the amanuensis for titles, proper names, and certain general propositions, etc. See for example the photograph of fol.8v., ch. 1, sect. a.
L.10, '<qui>' inserted by the amanuensis, after he had deleted 'quae'.

Page 84
L.19, in the MS 'Idque' is not cancelled, though clearly it ought to have been.
Ll.20-1,'ista', 'opinio', 'valida', 'molesta', 'sit' - all these were plurals until Bacon revised the text.
Ll.28-9, this interpolation stands in the left margin.
L.28, after 'apud', '[novitios]'.
L.31, after 'aberrat', '[Neque enim]'.
Ll.36-7, after 'caloris', '[ad tempus]<[perpetuo]>'.
L.38, before 'eo','[postea]'.
L.39, after 'calor','[minuatur prorsus]'.

Page 86
L.20, the interpolation replaces an illegible deleted word.
L.30, after 'alimentatum', '[cum]'.
L.32, the interpolation replaces '[plane]'.

Page 88
L.4, after 'est', '[quam]'.
L.13, '<prius>' inserted by the amanuensis.
L.15, after 'spiritus', '<[illius]> [sive partis aereae]'.
Ll.18-19, interpolation inserted by the amanuensis.

L.28, after 'emigratio', '[cum]'.
L.29, after 'partium', '[fiat]'.
L.31, '<quas>' inserted by the amanuensis.
L.34, MS 'rabigine'.

Page 90
L.11, '<post>' inserted by the amanuensis. After 'hiant', '[Maxime autem apparet contractio in rugis quae conspiciuntur in corporibus tenuioribus]'.
L.21, after 'in', '[tenuibus]'.
L.27, after 'solum', '[tenuia]'.
L.28, after 'tantum', '[per adductionem]'.
L.30, MS 'dessecata'.

Page 92
L.1, MS 'conquasatione'.
L.2, insertion made by the amanuensis.
Ll.14-23, these lines were drafted in the left margin. 'A1' indicates that they were to be followed by the material between 'A2' and 'B1' (p.96, ll.34-9) which was in turn to be followed by material between 'B2' and 'C1' (p.92. 1.38-p.94, 1.2), and then by material between 'C2' and 'D' (p.92, ll.24-35). After that comes the paragraph between 'D2' and 'E'.
L.17, after 'quod', '[sc]'.
Ll.24-38, the material between 'C2' and 'B2' was cancelled with an oblique stroke but was subsequently reinstated ('stet' in right margin) up to and including 'pergemus' (l.37). Ll.24-5, the endorsement 'seru' appears twice in the left margin, and on both occasions it was cancelled. 'Seru' is, no doubt, an abbreviation of 'seruntor', viz. 'let them be joined up', i.e. an instruction to a copyist to join up the passages endorsed 'A1', 'A2'-'B1' etc. in their new sequence.
L.24, 'C2', see note to ll.14-23.
L.24, this paragraph in the original draft began 'Neque tamen satis est'. Bacon cancelled 'tamen satis est' and inserted 'enim'. He then inserted 'C2' above 'Neque'. All these alterations were then cancelled and a new beginning to the paragraph inserted together with a new 'C2'.
L.24, after 'actiones', '[ipsas]'.
L.29, before 'modos', '[vias]'.
L.39, after 'putrefactione', '[eius generis quae]'.
L.40, after 'eadem', '[quaeque]'.
L.40, after 'res', '[sit]'.

Page 94
Ll.2-3, 'C1', 'D2', see note to p,92, ll.14-23.

L.3, before 'quas', '[priores]'.
L.4, insertion after 'vel', made by amanuensis.
Ll.7-10, this interpolation stands in the left margin.
L.10, the material from 'E' to 'AA2' (p.102, l.5) was to have been replaced by an extensive revised draft, see fols.16r-18v. Also see above ch. 4, sects. c-e.
Ll.12-13, interpolation inserted by the amanuensis.
L.18, '<emittitur>' inserted by the amanuensis.
L.21, '<sales>' inserted by the amanuensis.

Page 96
L.10, '<plerunque>' inserted by the amanuensis.
Ll.16-33, cancelled with an oblique stroke. In left margin next to l.20, 'seru' (see note to p.92, ll.24-38). The substance of ll.20-33 had been taken back to fol.5v (see p.94, ll.7-10).
Ll.34-5, this interpolation stands in the left margin. For 'A2' (l.34) and 'B1' (l.39) see note to p.92, ll.14-23.
L.38, after 'quam', '[per]'.

Page 98
L.1, 'seru' in left margin (see note to p.92, ll.24-38).
Ll.9-11, interpolation and cancellation made by the amanuensis.
L.18, insertion made by the amanuensis.
L.26, 'temerie' corrected to 'temperie' by the amanuensis.

Page 100
L.17, '<est>' inserted by the amanuensis.
L.20, 'restat', conjectural.
L.29, after 'inimicam', '[post hac]'.

Page 102
L.4, 'AA2' - see note to p.94, l.10.
L.5, 'applicanda' inserted by the amanuensis.
L.5, after 'inquisitio', '[et quasi aptanda]'.
L.6, before 'tangibilibus', '[vivent]'.
L.6, after 'quatenus', '[cum]'.
Ll.6-7, 'tangibilibus...inanimata', in left margin.
L.8, MS 'proporent'.
L.12, 'transeundum' also stands in the original draft; Bacon forgot to cancel it.
L.12, 'BB1' indicates that the revised text was meant to continue with the passage (fol.21r) between 'BB2' and 'CC1', see ch. 1, sect. b.
L.17, 'CC2' indicates that the cancelled title was to be omitted and that the text was to resume at 'DD1'. The title reappears uncancelled above the new 'Aphorismus 1' (fol.22r). For the significance of 'ℸ' see ch. 1, sect. b.

L.36, in the unrevised draft 'exponi' was 'exponantur'.

Page 104
L.3, after 'extrahere', '[Ille enim]'.
Ll.6-13, this paragraph was scribbled in the left margin.
L.6, after 'longe', '[ab]'.
L.7, after 'qui', '[...et]'.
L.12, 'minus' appears to reverse the intended sense so it may be a mistake.
Ll.14-17, drafted in the left margin.
L.14, for the significance of the trefoil mark see ch. 1, sect. b.
L.16, after 'quam', '[inte]'.
L.17, 'servaritur' - conjectural.
L.20, after 'fuere', '[et f]'.
L.21, after 'Spiritus', '[ipsi nativi]'.
L.27, after 'videmus', '[caulis]'.

Page 106
Ll.26-30, 'DD2' - 'EE1' - 'EE2': the interlinear interpolation 'Aphorismus 1' (marked 'DD2') was to have been followed by the interpolation (ll.27-9) which stands in the left margin (marked 'EE1') and then by the material in the original draft (marked 'EE2'). When Bacon revised the draft for the first time, he had intended that this should be the first aphorism in the sequence and that it should be taken back to the point marked 'DD1' (see p.102, l.20). He later decided that it should be placed third in the final order, and endorsed it '3α'. For the significance of the endorsement see ch. 1, sect. b.
L.29, before 'Explicatio', '[Ex]'.
L.36, after 'roborentur', '<[ut fit in f]>'.

Page 108
L.5, after 'multum', '<[Obstinatio partium spiritum]>'.
L.5, after 'metallis', '[videlicet non propter praedominantiam aut obstinationem, sed propter]'.
L.6, after 'frangit', '[contra]'.
L.7, 'sequacitas' was 'sequacitatem' in the unrevised draft.
L.7, after 'partium', '[crassiorum]'.
L.8, before 'adest', '[adsunt]'.
L.13, after 'illis', '[commisti sint]'.
L.17, after 'pin-', '[-guibus quae et ipsa fere rerum exudationes sunt, et habent spi]'.
L.21, 'H' - from this point down to 'H1' (p.110, ll.1), an oblique cancels the original draft. The endorsement 'seru' (see note to p.92, ll.24-38) stands in the left margin opposite 'H'; also in the left margin is the endorsement 'ad', possibly an abbreviation of 'adjungite', i.e. 'join up'.
L.22, interpolation inserted by the amanuensis.
L.23, see preceding note.
L.33, see preceding note.

Page 110
Ll.5-15, this interpolation was drafted across the top of the leaf and down the left margin.
L.8, after 'pellis', '<[vel? habet?]>'.
L.10, after 'arctant', '[condensant]'.
L.11, before 'quare', '[Itaque]'.
L.13, after 'vestis', '[calid]'.
L.13, MS 'unguinenta'.
L.14, MS 'disipatio'.
L.15, after 'ipsorum', '[und]'.
L.18, after 'Hoc', '[cum]'.
L.20, before 'ad', '[eis]'.
L.21, 'GG1', the significance of this is not known.
L.22, 'Aphorism. 4' - virtually obliterated by the interpolation (see note to ll.5-15).
L.27, after 'et', '[quasi]'.
L.28, after 'maioribus', '[et]'.
L.28, after 'minoribus', '[cellulis]'.
L.30, before 'ab', '[rei]'.
L.34, after 'spiritus', '[facilius]'.
L.35, before 'desunt', '[rediguntur in ordinem. Atque <[Itaque]> naturalia quaeque (quae vocantur)]'.
L.37, after 'corpora', '[(de consistentibus loquimur)]'.
L.38, before 'quae', '[et materiam tanquam fortuito praeparatam]'.

Page 112
L.2, before 'ut', '[quales fiunt in gummis]'.
L.3, after 'est', '[nec minus in gemmis quae profecto plerunque sunt rupium atque minerarum exudationes]'.
L.4, before 'quaeque', '[et]'.
L.7, after 'Itaque', '[vitrum et]'.
Ll.20-6, drafted in the left margin.
L.21, 'causari' was 'causant' until corrected.
L.21, before 'et', '[non comperit]'.
Ll.27-34, cancelled with three oblique strokes; 'seru' inserted in the left margin (see note to p.92, ll.24-38). This was then almost obliterated by the material (ll.20-6) subsequently drafted in the margin.
Ll.35-6, the aphorism to which this is the 'explicatio' appears on fols. 11v-12r (p.116, ll.26-31), where the endorsements 'x' and 'B' occur again. For the meaning of the other endorsements see ch. 1, sect. b.

Page 114
L.14, after 'qua', '<[in superiore aphorismo]>'.
L.20, after 'spiritum', '[vitalem]'.
L.26, before 'prorsus', '[spiritus]'.

Page 116
Ll.1-24, interpolation drafted in the left and bottom margins of fol.11v and the bottom margin of fol.12r. The first 'C' stands in the body of the text to indicate where this large interpolation (which begins with the second 'C') was to be inserted in the revised text. The two 'Ds' (l.18) were, of course, meant to indicate that the interpolation continued from the bottom of fol.11v to the bottom of fol.12r.
L.4, before 'Verum', '[Quod vero]'.
L.4, after 'Verum', '[illud]'.
L.6, after 'ut', '[qui]'.
L.8, ... an illegible word, possibly a verb.
L.20, after 'pinguis', '[ole]'.
L.24, ... part of the last word of the interpolation has been trimmed off; the word may be an adjective.
Ll.26-31, see note to p.112, ll.35-6.
L.32, see ch. 1, sect. b.
L.35, after 'detentus', '[vivifi]'.
Ll.36-7, Bacon omitted to insert the word 'Explicatio' between these two lines.

Page 118
Ll.11-12, after 'detinetur' Bacon inserted two short vertical strokes - the reason for which is not clear.
L.21, '<olei>' inserted by the amanuensis.

Page 120
Ll.23-4, parentheses supplied by transcriber.
L.26, after 'perfusa', '[et exoluta]'.
L.37, 'alimentationem', MS 'almicutationem'.

Page 122
L.20, '<idem>' inserted by the amanuensis.
Ll.23-5. In the left margin stands a cancelled and blotted interpolation: 'Quod inclusum spiritum suffocando...vera bene cedis...expectanda est, non ab humido'. This is presumably an aphorism title that Bacon wished to be inserted here until he had a change of heart and made a new title out of ll.29-32, and also cancelled the interpolated line 27 which was to have stood after the cancelled title.
L.28, see ch. 1, sect. b.

Page 124
L.33, after 'exhorrent', '[ac]'.
L.33, 'sint' was 'sunt' before revision.
L.38, '<ut>', inserted by the amanuensis.

Page 126
Ll.14-21, interpolated in the left margin.
L.14, after 'calorem', '[contin]'.
L.19, before 'versus', '[ad]'.
L.22, before 'Verum', '[Itaque]'; after 'Verum', '[quod]'.
Ll.24-7, interpolations made by the amanuensis.

Page 128
Ll.6-10, drafted in top and left margins.
L.6, after 'magni', '[usum]'.
L.13, after 'sed', '[ut melius percipiantur antedicta]'.
L.18, after 'nonnihil', '[et tamen ipse interim a spiritu extenditur et effingitur]'.
L.24, after 'in', '[carie]'.
L.30, before '<Putredo>', '[caries]'.
L.34, fol.15a r the bottom half of this leaf is torn off.
L.34, after 'vel', '[nimium]'.

Page 130
L.2, 'movere', MS 'monere'.
L.5, 'E2' - material from here to 'AA1' (p.144, l.7) was meant to displace the passage endorsed 'E' - 'AA2', see note to p.94, l.10.
L.5, after 'vero', '[ponendum est]'.
L.6, after 'loco', '[ponendum est]'.
Ll.10-11, 'perpetua...coelestium', drafted in the left margin.
L.11, after 'spiritum', '[partibus rei crassioribus obductum et obsessum]'.
L.16, after 'tenue', '[en]'.
L.17, 'tenui', corrected from 'tenuis'.
L.21, after 'illo', '[fod]'.
L.23, after 'spiritus', '[quae]'.
L.32, after 'tangibili', '[plane]'.
L.32, after 'in', '[partibus]'.
L.35, after 'lineas', '[tantum]'.

Page 132
L.1, after 'spiritus', '[veg]'.
L.10, before 'Haec', '[At]'.
L.13, after 'invisibilia', '[omnia]'.
L.14, after 'percollant', '[at ut atque]'.
L.15, after 'vocant', '[ill]'.
L.22, after 'differentia', '[alia comminutionis, alia inaequalitatis]'.
L.27, after 'corpora', '[per quae]'.
L.28, after 'ubi', '[locantur et]'.
L.32, after 'spiritus', '[prout spiritus est sibi magis vel minus continuus]'.

Page 134
L.2, after 'in', '[om]'.
L.2, after 'partibus', '[tangib]'.
L.3, after 'semper', '[aliquod]'.
L.3, after 'et', '[olei sive corporis crudi et pinguis]'.
Ll.6-10, interpolation drafted in the left margin.
L.7, after 'quam', '[igneorum]'.
L.11, after 'Suscipiunt', '[autem]'.
L.11, after 'spiritus', '[verum]'.
L.12, 'superveniunt', MS 'supereniunt'.
Ll.16-18, the interpolation (left margin) appears to be an *aide memoire* reminding Bacon of the order that he planned to adopt in this the revised treatment of the original version (fols.5v-8r) of this discussion.
L.19, before 'naturae', '[constantior]'.
L.21, after 'et', '[facile cognata]'.
L.23, before 'duae', '[scili]'.
L.26, after 'ad', '[desid]'.
L.27, before 'illa', '[et primus]'.
L.27, before 'Omnis', '[enim]'.
L.28, before '<eum>', '[illos]'.
L.32, after 'spiritus', '<[...]>'.
L.35, after 'illud', '[terrestre]'.
L.36, in the left margin two illegible deleted words.
L.37, after 'per', '[se hoc]'.

Page 136
L.3, after 'datur', '[in proximo]'.
L.4, after 'se', '[rest]'.
L.5, before '<et>', '[et]'.
L.6, after 'se', '[int]'.
L.9, before 'Neque', '[Postremo]'.
L.15, 'Frenatur autem' written twice in MS.
L.19, MS 'subtilizacionem'.
L.22, after 'rei', '[co]'.
L.26, after 'externis', '[non facil]'.
L.26, after 'non', '[curat]'.
L.36, after 'illud', '[sit liquidum]'.
L.37, after 'liquidum', '[sit]'.

Page 138
L.1, after 'praecipue', '[...]'.
L.5, after 'corpus', '[semper aut spiritus]'.
L.6, before 'spiritum', '[aut]'.
L.8, after 'habet', '[pleniorem et]'.
L.13, after 'satis', '[simpliciter]'.
L.18, after 'ex', '[utroque]'.
L.21, before 'apparent', '[ne]'.
L.22, 'reperitur' altered to 'reperire'.

L.22, after 'corpora', '[similia]'.
L.23, before 'quae per', '[exudationes rerum]'.
L.25, MS 'dissim[ale]ilares'.
L.30, after 'Atque', '[de]'.
L.31, after 'praecipuae', '[naturae]'.
L.34, after 'fuga', '[abruptionis tactus sive]'.
L.35, before 'torturae', '[exporrectionis praeternaturalis]'.
L.36, after 'crassum', '[hade]'.
L.36, after 'et', '[aegre se movet loco]'.
L.36, after 'eum', '[quae fertur]'.

Page 140
L.1, after 'constet', '[tamen si corpus fuerit paulo compactius]'.
L.1, after 'neque', '[plan]'.
L.6, before 'Quod', '[Itaque]'.
L.7, after 'aut', '[qui]'.
L.9, after 'crassam', '[apte]'.
L.13, before '<rei>', '[rei]'.
L.16, after 'et', '[het]'.
L.21, after 'corpore', '[alimentato]'.
L.25, before 'ut', '[ut spiritui obediant at]'.

Page 142
L.1, after 'sed', '[in eadem]'.
L.2, after 'nisi', '[aut temp]'.
L.3, 'invitetur' - MS 'invite[n]tur'.
L.9, after 'quatuor', '[potissimum]'.
L.9, before 'calor', '[et]'.
L.11, after 'aut', '[immutationes]'.
L.11, after 'alterationes', '[aut]'.
L.12, before 'Alia', '[Operantur]'.
L.13, before 'in arena', '[si corpus circunfundet]'.
L.18, after 'et', '[opercula]'.
L.19, before 'aut', '[alia cum]'.
L.22, before 'duabus', cancelled illegible word.
L.22, before '<cum>', '[cur]'.
L.23, after 'crassiorum', '[ponendo aut impedendo]'.
L.25, after 'vicissim', '[agant]'.
L.26, before 'sunt', '[ad rem hae sunt] [quae in rem]'.
L.27, after 'substantiam', '[suam]'.
L.27, before 'inspissent', '[in sp]'.
L.28, before 'poris', '[ai]'.
L.29, after 'demulceant', '[aut]'.
L.30, before 'et', '[aut]'.
L.31, after 'Etiam', '[illa duo]'.
L.31, after 'utrum', '[ad]'.
L.34, after 'rei', '[atque]'.
L.36, after 'esse', '[perspeximus]'.

Page 144
L.2, after 'nosse', '[vias]'.
L.3, after 'aut', '[partior]'.
L.5, before 'ad', '[con]'.
L.7, for the significance of 'AA1' see note to p.130, l.5.
Ll.7-8, this note, drafted in the left margin, probably refers to the two Part B aphorisms which would have been located here in the revised text, see ch. 1, sect. b.
L.9, what the '+' signs mean is not known.
L.16, after 'igneae', '[hic apud nos]'.
L.16, MS 'con[substalit]substantiale'.
L.19, before 'a corpore', '[ab omn] [ab aliqua]'.
L.22, after 'proprie', '[acced]'.
L.27, after 'tamen', '[e ta]'.
L.27, after 'consuetudine', '[quae vis consuetudinis manet]'.

Page 146
L.19, after 'corpus', '[inspissat]'.
L.21, after 'consistenti', '[cogu]'.
L.26, MS 'calfacit'.
L.29, after 'liberatus', '[absque irritatione exhal]'; 'et' supplied by the transcriber.
L.40, after 'ratio', '[ne]'.
L.41, after 'cum', '[utrumque]'.

Page 148
L.6, after 'praeter', '[evol]'.
L.7, the endorsement 'Ad.' is probably an abbreviation of 'addite', i.e. a reminder to include this uncancelled item in some future fair copy of the revised text.
L.13, after 'tempus', '[spiritus in ipso tempo]'.
L.16, 'Ad.' - see note to p.148, l.7.
L.17, after 'tanquam', '[certe]'.
Ll.22 - p.150, l.1, 'BB2' - 'CC1' see note to p.102, l.13.
L.22, 'desc.' see ch. 1, sect. b; ch. 1, note 43.
L.22, before '<cuiquam>', '[quaeddam]'.
L.23, before '<si>', '[quod nos]'.
L.25, after 'insunt', '[tum quod in ipsis] <[huius rei praecipue et]>'.
L.25, '<ac multo...praecipue>' drafted in the left margin.
L.28, after 'sanguis', '[cur humores, caro]'.
L.29, 'quales' - Bacon wrote 'qualia' and then altered the ending.
L.30, after 'ossa', '[ceu]'.
L.32, after 'retro', '[adeo ut spiritus]'.
L.32, after 'sed', '[et]'.
L.34, before 'et', '[eget]'.
L.36, before 'unde', '[sed]'; after 'unde', '[et]'.
L.37, before 'Tum', '[Ex quo]'.

Page 150
L.1, 'CCl', see note to p.102, l.13.
L.2, except for the title the whole of fol.22r is crossed out with two vertical strokes.
Ll.2-3, this heading, here partly trimmed off, was transferred to this point from fol.8v, see ch. 1, sect. b.
L.5, 'descr.' - see ch. 1, sect. b; ch.1, note 43.
L.18, before 'profecto', '[habet]'.
L.21, after 'corpus', '[crasso]'.
L.24, after 'Hoc', '[autem]'.
L.33, before 'uvae', '[qu]'.

Page 152
L.2, before 'et', '[exhalatione]'.
L.3, after 'aetatem', '[quae ipsa]'.
L.3, before 'nimirum', '[tabidum]'.
L.4, after 'lenem', '[concoctionem]'.
L.5, after 'ignis', '[aut iam]'.
L.7, before 'e', '[Atque plerunque aetas exhalation]'.
L.7, after 'aetatis', '[quae nil aliud]'.
L.8, before 'apertae', '<[apertae sunt]>'.
L.8, after 'sunt', '[est]'.
L.10, 'incendens', conjectural.
L.17, before 'aut', '[latere]'.
L.19, after 'et', '[calcitem]'.
L.20, after 'magis', '[nec]'.
L.21, after 'humore', '[qui]'.
L.21, after 'ipsum', '[vertitur]'.
L.24, the whole of fol.23r is crossed out with two vertical strokes.
L.26, for the significance of the trefoil mark see ch. 1, sect. b.
L.27, 'descr.' - see ch. 1, sect. b; ch. 1, note 43.
L.27, before 'et', '[spir]'.
L.31, before 'Inter', '[Itaque flammae autem]'.
L.31, after 'et', '[paulo]'.

Page 154
L.2, after 'in', '[hominibus]'.
L.4, after 'cibi', '[membrum et]'.
L.5, after 'motus', '[tum]'.
L.6, before 'alias', '[ad illos]'.
L.6, after 'detrahunt', '[nec nisi per]'.
L.7, fol.24r, cancelled with a single vertical stroke.
L.7, for the trefoil mark see ch. 1, sect. b.
L.11, not in MS, but supplied by the transcriber.
L.13, after 'spiritus', '[nec evolet]'.
L.19, MS 'temperanamenti'.
L.19. after 'alia', '[a]'.
L.25, after 'ipsa', '[tamen]'.

L.28, after 'inverso', '[ubi flamma aut calor]'.
L.36, after 'aquam', '[gelidam]'.

Page 156
L.1, after 'propter', '[contra]'.
L.3, after 'si', '[atta]'.
L.4, before '<aer>', '[aeris]'.
L.4, after 'ad', '[emitt]'.
L.8, et seq., fol.25r cancelled with two vertical strokes.
L.17, 'descr' - see ch. 1, sect. b; ch. 1, note 43.
L.21, before 'manet', a single illegible word.
L.30, before 'sunt', a single illegible word.

Page 158
L.6, 'diversa', Bacon wrote 'diversus' and then altered the ending.
L.9, et seq., fol.26v cancelled with a single vertical stroke.
L.10, after 'ramosus', '[ex]'.
L.13, before 'vegetabilium', '[simpliciter]'.
L.16, 'descr.' - see ch. 1, sect. b; ch. 1, note 43.
L.16, after 'Spiritus', '[ma]'.
L.17, after 'deinde', '[in]'.
L.19, after 'canales', '[per quas se continuare et movere]'.
L.22, after 'nititur', '[Itaque perfossio, attenuatio, et evolatio sunt simpliciter]'.
L.25, after 'integrale', '[determinatum]'.

Page 160
L.11, after 'differentiae', '[An]'.
L.13, after 'jacta', '[ea quae]'.
Ll.16-38, cancelled with a single vertical stroke.
L.20, 'desc.' - see ch. 1, sect. b; ch. 1, note 43.
L.21, after 'enim', '[possit inesse videatur in rebus]'.
L.21, after 're', '[quacunque]'.
L.22, after 'si', '[sit]'.
L.22, after 'parce', '[rebus insit]'.
L.24, after 'Itaque', '[des] [omnes in viriditate sua vegetabilia]'.
L.24, after 'corpora', '[fit omne]'.
L.24, before '<a>', '[a matricibus suis e]'.
L.27, after 'collata', '[habita ratione]'.
L.27, after 'vigorem', '[de]'.
L.29, before 'et', '[spiritu]'.
L.31, after 'spiritu', '[suo destituuntur et suo florem]'.
L.34, after 'succum', '[et spiritum praebent magis]'.
L.35, after 'paucum', '[valent]'.
L.37, after 'et', '[sibi]'.

Page 162
L.2, 'Ad.', see note to p.148, l.7.
L.2, before 'Spiritus', '[Aer simplex praesertim frigidus non est co]'.
L.2, after 'qui', '[pl]'.
L.4, after 'pinguia', '[non]'.
L.8, after 'secundo', '[quo]'.
L.10, after 'minus', '[quae]'.
L.10, after 'potens', '[Omnia enim] <[Plurima]>'.
L.13, after 'etiam', '[ob sympathia]'.
L.16, after 'aere', '[conspiratione inita inter interiorem et exteriorem]'.
L.17, after 'et', '[aer huiusmodi]'.
L.19, after 'diu', '[et praeter de]'.
L.19, before 'ad', '[aeri]'.
L.22, before 'simplici', '[sin]'.
L.22, before 'Quin', '[At illis quin a]'.
L.22, after 'valet', '[fere plerum]'.
L.26, after 'aer', '[nis]'.
L.26, after 'clausus', '[et infectus a corpore magis]'.
L.26, after 'ab', '[ex hali]'.
L.26, after 'corporis', '[unde magis et magis cognata]'.
L.30, 'Ad.', see note to p.148, l.7.

Page 164
L.30, 'Ad.', see note to p.148, l.7.
L.34, after 'latent', '[enim]'.
L.39, after 'remediis', '[natu]'.

Page 166
L.12, after 'subtilitas', '[subtilitas]'.
L.14, MS 'noscenda'.
Ll.15-16, before '<et>' ... '<et>' ... '<et>', '[aut]' ... '[aut]' ... '[aut]'.
L.17, after 'quibus', '[homines] <[illi]>'.
L.18, after 'natura', '[per]'.
Ll.20-8, drafted in left and bottom margins.
L.20, after 'de', '[quibus]'.
L.21, after 'abscissi', '[et partes crassiores]'.
L.21, after 'intermisti', '[inter] [insunt]'.
L.22, after 'carni', '[spr]'.
L.23, before 'dum', '[atque]'.
L.24, before 'in', '[an]'.
L.25, 'viventis', conjectural.
L.28, these words are conjectural, and supply words trimmed off at the bottom of the leaf. The same words appear at the end of the fol.28v interpolation (see p.168, ll.4-5).
Ll.29-33, l.37 - p.168, l.5, drafted as a continuous passage on fol.28v. The interpolation (ll.34-7) was drafted in the left margin of fol.28v.

L.29, 'Ad.', see note to p.148, l.7.
L.30, after 'inanimatis', '[de]'.
L.31, before 'et', '[re]'.
L.33, after 'moli', '[p]'.
L.34, after 'spiritum', '[illum qualem eum in inanimatis descripsimus]'.
L.37, after 'viventium', '[Libentarum? illae partes]'.

Page 168
L.1, after 'mortem', '[illa]'.
L.1, after 'cadavere', '[in]'.
L.4, after 'de', '[actioni]'.
L.6, before '<Verum>', '[Atque]'.
L.9, after 'illos', '[in]'.
L.11, after 'inter', '[inanimata]'.
Ll.15-27, cancelled with three diagonal strokes.
L.15, 'Ad.', see note to p.148, l.7.
L.28, after 'spiritus', '<[ad]>'.
L.32, before 'longe', '[immenso differant]'.
L.33, after 'Atque', '[in vegetabili calor non sentitur]'.
L.35, after 'concipit', '[Om]'.
L.36, before 'aqua', '[aqua...debito modo praeparata per concoctionem et distillationem]'.
L.38, after 'quae', illegible cancelled word.

Page 170
L.1, before '<At>', '[Qua propter]'.
L.3, 'succedaru' corrected by Bacon to 'succedati'.
L.5, after 'enim', '[est]'.
L.6, after 'alimento', '[quemadmodum aer durabilior]'.
L.6, after 'est', '[actio]'.
L.7, after 'videlicet', '[accensio]'.
L.10, after 'tractamus', '[nempe]'.
L.11, before 'partium', '[per alimentum]'.
L.11, before 'In', '[in corpore vivente] <[in corpore vivente]>'.
L.14, 'A.', see note to p.148, l.7.
L.14, after 'in', '[ipso motu suo]'.
L.17, before 'potius', '[et ad se dilatandum potius quam contrahendum]'.
L.29, before 'cum', '[et]'.
L.35, after 'non', '[admodum]'.

General notes

1 The wording of the two introductory paragraphs is very similar to that of the 'Aditus' of the "Historia vitae et mortis"; 'Quod reparari potest sensim, atque primo Integro non destructo, id potentia aeternum est, tanquam Ignis Vestalis. Cum igitur viderent medici et philosophi, ali prorsus animalia, eorumque corpora reparari et refici; neque tamen id diu fieri, sed paulo post senescere ea, et ad interitum propere deduci; mortem quaesiverunt in aliquo quod proprie reparari non possit: existimantes Humorem aliquem Radicalem et Primigenium non reparari in solidum, sed fieri jam usque ab infantiam appositionem quandam degenerem, non reparationem justam; quae sensim cum aetate depravetur, et demum pravum deducat ad nullam.' Bacon goes on to deny that degeneration begins in infancy; before adulthood the size and quality of the parts improve 'so that the matter whereby they are repaired would be eternal, if the manner of repairing them did not fail' ("Works", II, 106, cf.V, 218).

2 For radical moisture and natural heat see ch. 5, sect. a. 'Radicalis' and 'primigenius' are, when attached to 'humor', virtual synonyms; cf. J. Fernel, "Medicina", Paris, 1554, p.109: 'Hic idcirco est quem prae caeteris nativum humorem appellarunt, alii proprio si forte inepto nomine, humidum radicale: nos id ut primigenium ita dicere possumus vitale et salutare humidum, quod spiritus et caloris totiusque vitae fundamentum est et pabulum.'

3 See ch. 5, sect. a, and Telesio, op. cit. (ch.5, 18), pp.540-1: 'Infantile puerileque jecur, quoniam mollissimum ejusque sapor, dulcis aut subpinguis, parum omnino a carnis sapore differens, et color puniceus quidem, at ad album magis quam ad nigrum vergens, et importatum chilum in sanguinem agit bene liquidum beneque purum ... Senile vero crassum est durumque et nigrum salsumque, et chilum in hujusmodi agit sanguinem, quod copiosus vehemensque ipsius calor molliores tenuioresque propriae molis et importati chili partes in summam agit tenuitatem eamque educit omnem, et qualis quantusque propriae inest moli, talem tantumque sese sanguini, quem conficit, copiosum scilicet vehementemque, indit.'

4 See ch. 5, sect. a.

5 Loc. cit. Also see Pagel, op. cit. (ch.5, 7), pp.294-5. The idea that radical moisture was derived from semen is common in Avicennan tradition; see for example Peter of Spain, "De longitudine et brevitate vitae", in Pedro Hispano, "Obras filosoficas", 4 vols., Madrid, 1952, III, 429: 'Consumptio autem ista humidi et extinctio calidi ordine irregressibili procedunt. Nam humidum radicale ex primo spermate procedit. Sperma autem primum regenerationem non patitur; ipsum enim ex parentum humiditatibus

emanans per virtutes ipsorum et organa determinata productum nequit per virtutes et actiones filiorum regenerari.'

6 For Bacon's views on the relationship between body heat and age see ch. 5, sect. a.

7 For the signs of old age see "Works", II, 210-12. See also Telesio, op. cit. (ch.5, 18), pp.548-50; Doni, op. cit. (ch.3, 52), pp.358-60.

8 The doctrines of this paragraph and the one before it are summarised in the "Historia vitae et mortis", "Works", II, 106-7: 'Itaque duplex debet esse inquisitio; altera de consumptione aut depraedatione corporis humani; altera de ejusdem reparatione aut refectione: eo intuitu, ut altera, quantum fieri possit, inhibeatur, altera confortetur ... Etenim quae spiritus innatus ... et aer ambiens operatur super inanimata, eadem et tentat super animata; licet superadditus spiritus vitalis illas operationes partim infringat et compescat, partim potenter admodum intendat et augeat. Nam manifestissimum est, inanimata complura absque reparatione ad tempus bene longum durare posse: at animata, absque alimento et reparatione, subito concidunt et extinguuntur, ut et ignis. Itaque inquisitio duplex esse debet; primo contemplando corpus humanum, tanquam inanimatum et inalimentatum; deinde tanquam animatum et alimentatum.' Also see fols.28r, 29r.

9 For the 'actio triplex' see ch. 4, sect. b.

10 Cf. "Works", II, 121-2.

11 Cf. ibid., I, 310, II, 282. For a similar account of the cause of rusting see "Historia densi et rari", ibid., II, 264. For smell as evidence of the spirits' activities see "Historia vitae et mortis", ibid., II, 120.

12 Cf. ibid., II, 120-1, 287-8.

13 Cf. "Historia vitae et mortis", ibid., II, 119: 'Miris modis homines, more noctuarum, in tenebris notionum suarum acute vident ad experientiam, tanquam lucem diurnam, nictant et caecutiunt. Loquuntur de Elementari Qualitate Siccitatis; et de desiccantibus; et de naturalibus periodis corporum, per quas corrumpuntur et consumuntur; sed interim, nec de initiis nec de mediis nec de extremis Desiccationis et Consumptionis aliquid quod valeat observant.' Also see ibid., II, 157, 281. 'Humectationes' - according to the radical moisture theory, age desiccates so ageing can be delayed by measures designed to keep the parts moist; see, for example, Peter of Spain, op. cit. (5), pp.457, 478-9.

14 Bacon identified these two operations as primary causes of putrefaction, see "Works", II, 121.

15 The interpolation at the end of this paragraph does not refer to the order in which these topics are treated in the pages immediately following. It refers to the revised order (fols.16r-18v).

16 Cf. "Works", II, 376.

17 Cf. fol.16v; also see "Historia vitae et mortis", "Works", II, 218-19.

18 See note 67 and cf. fol.17v.

19 Cf. fol.18r-v.

20 Cf. fol.18r.

21 Cf. Conrad Gesner, "The treasure of Evonymus", London, 1559; facsim. reprint, Amsterdam, 1969, p.2. Gesner's material on the distillation of vegetable matter is very similar to Bacon's.

22 This is one of a number of practical recommendations added to Part A aphorisms as Bacon revised them. For other such additions see fols.10v, 11r, 11v, 15v. For the causes and effects of sweat see "Works", II, 363, 566.

23 Cf. fol.26v.

24 Cf. "Historia densi et rari", "Works", II, 263: 'Etiam gemmae complures videntur esse eruptiones succorum puriorum ex rupibus; cum tam gummi quam gemmae rupium deprehendantur (ex splendore) esse succi percolati et depurati; adeo ut etiam saxa et lapides videantur ex spiritu innato tumescere.'

25 Cf. ibid., II, 268: 'Apertura aquae talis est. Sub primo calore emittit vaporem paucum et rarum: neque intra corpus alia conspicitur mutatio. Continuato calore, corpore integro non insurgit, nec etiam bullis minutis in modum spumae; sed per bullas majores et rariores ascendit, et in copiosum vaporem se solvit ... Apertura olei talis est. A primo calore ascendunt guttulae quaedam aut granula per corpus olei sparsa; idque cum crepitatione quadam. Interim nec bullae in superficie ludunt (ut in aqua), nec corpus integrum tumet, nec quicquam fere halitus evolat. At post moram nonnullam, tum demum corpus integrum insurgit, et dilatatur expansione notabili tanquam ad duplum, et copiosissimus et spissus admodum evolat halitus.'

26 Cf. "Historia vitae et mortis", "Works", II, 175-80; also cf. fol.27v.

27 Cf. fol.27v.

28 On 'subtle textures' and heat see "Works", I, 234; also see note 58.

29 Cf. "Works", II, 374-7.

30 See fols.9v-10r.

31 Cf. "Historia vitae et mortis", "Works", II, 157; also see ch. 5, sect. a.

32 Cf. "Historia vitae et mortis", "Works", II, 178: 'Ante omnia igitur usum olei, vel olivarum, vel amygdalini dulcis, ad cutem extra ungendam, ad longaevitatem conducere existimamus; eaque unctio debet fieri singulis auroris cum exitur e lecto, cum oleo in quo admisceatur parum salis nigri et croci. Unctio autem levis debet esse, ex lana aut spongia molliori, neque quae stillet super corpus, sed cutem tantum intingat et inficiat.'

33 Cf. fol.15r-v; also see "Works", II, 362, 445-6.

34 Cf. "Historia vitae et mortis", "Works", II, 212-13. For Bacon's own experiments on the preservation of bodies see Rees, op. cit. (ch. 1, 1), pp.401-5.

35 Bacon is here looking forward to the (unwritten) part of De viis which was to consider animate beings *qua* animate.

36 Cf. fols. 4r, 12r-v.

37 This suggests that the De viis would have perhaps contained bodies of empirical data. For the significance of this point see ch. 5, sect. b. Also cf. "Historia vitae et mortis", "Works", II, 177: 'Hodie se pingunt Brasilienses et Virginienses, qui sunt (praesertim illi priores) admodum longaevi; adeo ut quinque abhinc annis Patres Galli non nulles convenerint, qui aedificationem Fernamburgi, annis abhinc centum et viginti, ipsi ad tunc virilis aetatis, meminissent.'

38 The preceding aphorism mentioned here would not necessarily have been the preceding one in the revised order. The preceding aphorism and

this one would probably have been conflated in the revised order, see ch. 1, sect. b, Table 1, cols.3 and 4.

39 Cf. Spedding, op. cit. (ch. 1, 11), III, 93-8.

40 Cf. "Works", I, 344, 561, "Abecedarium", (ch. 1, 1), fols.51v-52r.

41 Cf. "Novum organum", "Works", I, 344: 'Invenitur autem in aliis corporibus in gradu quodam inferiore; quemadmodum dictum est de sanguine et urinis, quae non solvuntur donec spiritus, qui partes earum commiscebat et cohibebat, emissus fuerit aut suffocatus. Neque iste motus omnino spiritibus proprius est, licet in plerisque corporibus spiritus dominentur ob motum celerem et penetrationem.'

42 Bacon is probably thinking here of Paracelsian experiments in analysis by fire - experiments intended to demonstrate the theory of the three principles, sulphur (oil), mercury (water), salt (solid residuum). For these experiments see C. L. Temkin, G. Rosen, G. Zilboorg, & H. E. Sigerist (eds.), "Four treatises of Theophrastus von Hohenheim called Paracelsus", Baltimore, 1941, p.46; A. G. Debus, "The English Paracelsians", London, 1965, pp.28-9. Also see Spedding, op. cit. (ch. 1, 11), III, 94, where Bacon speaks of earth, water, and oil - 'those three bodies which the alchemists do so much celebrate as the three principles of things' and 'which it pleaseth them to term Salt, Mercury, and Sulphur'.

43 Cf. "Novum organum", "Works", I, 335: 'Atque primo quoad auxilium caloris; hinc fit, quod calor pronuntietur esse illud quod separet Heterogenea, congreget Homogenea. Quam definitionem Peripateticorum merito derisit Gilbertus; dicens eam esse perinde ac si quis diceret ac definiret hominum illud esse quod serat triticum et plantet vineas: esse enim definitionem tantum per effectus, eosque particulares.' The source of the view rejected by Bacon and Gilbert is in Aristotle, "Generation of animals", (ch. 4, 35), p.157 ff.

44 See fols.14r-v.

45 Cf. "Historia vitae et mortis", "Works", II, 185: 'Itaque in usu sint potus illi, qui absque omni acrimonia aut acedine subtiles tamen sint; quales sunt vina (ut ait anus apud Plautum), vetustate edentula, et cervisia eiusdem generis.' Here, as in the manuscript, Bacon has misremembered his source - the comedy "Poenulus" by Plautus. Lycus the pimp, not anus, delivers the phrase that Bacon had in mind:

> 'Is, leno, viam
> Ubi tu Leucadio, Lesbio, Thrasio, Chio,
> vetustate vino edentulo aetatem inriges;
> ibi ego te replebo usque unguentum geumatis,
> quid multa verba?'

See P. Nixon (ed. & tr.), "Plautus with an English translation", (Loeb) 5 vols., Cambridge, Mass., 1959, IV, 70.

46 See fols.29r-v.

47 Cf. "Novum organum", "Works", I, 311.

48 Cf. "Sylva sylvarum", "Works", II, 451.

49 Cf. ibid., II, 453, 510-11.

50 Cf. ibid., II, 529.

51 Cf. ibid., II, 559: 'It is affirmed both by ancient and modern observation, that in furnaces of copper and brass where chalcites (which

is vitriol) is often cast in to mend the working, there riseth suddenly a fly ... which is a noble instance, and worthy to be weighed; for it sheweth, that as well violent heat of fire as the gentle heat of living creatures will vivify, if it have matter proportionable.' Bacon's modern authority may be Doni, op. cit. (ch. 3, 52), p.376. The ancient authority is Aristotle, "Historia animalium", (ch. 4, 35), pp.183-5.

52 Cf. "De fluxu et refluxu maris", "Works", III, 58: '...fieri enim prorus nequit, ut interiora terrae similia sint alicui substantiae quam oculus humanus videt, siquidem omnia apud nos a sole et coelestibus laxata, subacta, aut infracta sint, ut cum iis quae talem nacta sunt locum quo vis coelestium non penetret neutiquam consentire possint...'; "Novum organum" (ibid., I, 346): 'Huius autem appetitus imago ex parte tantum cerni potest; quia hic apud nos, ex subactione et concoctione coelestium, omne tangible non tantum non condensatum est ad ultimitatem, sed etiam cum spirito nonnullo miscetur.' Also see ibid., III, 95, 98, 779; Rees, op. cit. (ch. 1, 17), pp.204-5.

53 Cf. fols.22r, 25r; "Historia vitae et mortis", "Works", II, 213: 'Spiritus autem ille (de quo loquimur) non est virtus aliqua, aut energia, aut entelechia, aut nugae: sed plane corpus tenue, invisibile; attamen locatum, dimensum, reale...'

54 See fols.5r-v. Also see ch. 1, sect. b.

55 For this trichotomy see ch. 3, sect. b. Cf. fol.26v; "Historia vitae et mortis", "Works", II, 214-15. Also see footnotes 96-9 below.

56 "Historia vitae et mortis", "Works", II, 214-15: 'Sunt autem duo discrimina praecipua inter spiritus mortuales et spiritus vitales; alterum, quod spiritus mortuales minime sibi continuentur, sed sint tanquam abscissi et circundâti corpore crassiore, quod eas intercipit; quemadmodum aer permixtus est in nive aut spuma. At spiritus vitalis...etiam duplex est; alter ramosus tantum, permeans per parvos ductus et tanquam lineas; alter habet etiam cellam, ut non tantum sibi continuetur, sed etiam congregetur in spatio aliquo cavo, in bene magna quantitate...atque in illa cella est fons rivulorum... Ea cella praecipue est in ventriculis cerebri, qui in animalibus magis ignobilis angusti sunt...at animalia nobiliora ventriculos eos habent ampliores...'

57 Speaking of 'Latent Configuration' in the "Novum organum", "Works", I, 234, Bacon writes: 'Transeundum plane a Vulcano ad Minervam, si in animo sit veras corporum texturas et Schematismos (unde omnis occulta atque, ut vocant, specifica proprietas et virtus in rebus pendet; unde etiam omnis potentis alterationis et transformationis norma educitur) in lucem protrahere. Exempli gratia; inquirendum, quid sit in omni corpore spiritus, quid essentiae tangibilis; atque ille ipse spiritus, utrum sit copiosus et turgeat...abscissus, aut continuatus.'

58 In Bacon's philosophy this is an important idea. He repeatedly insisted that it was necessary to research the 'subtleties' of nature. By 'subtleties' he meant, among other things, the actions of the spirits referred to in the preceding paragraph. Cf. "Works", I, 168 : 'Itaque contemplatio fere desinit cum aspectu; adeo ut rerum invisibilium exigua aut nulla sit observatio. Itaque omnis operatio spirituum in corporibus tangibilibus inclusum latet, et homines fugit. Omnis etiam

subtilior meta-schematismus in partibus rerum crassiorum...latet similiter..,' Also see fol.29r. For the idea of 'subtlety' see Rees, op. cit. (ch. 2, 9), 567-71.

59 According to the "De augmentis", "Works", I, 606, vital spirit is 'aura...ex natura flammea et aerea conflata, aeris mollitie ad impressionem recipiendam, ignis vigore ad actionem vibrandam, dotata; partim ex oleosis, partim ex aqueis nutrita...' Also cf. fol.29v, and see ch. 2, sect. b.

60 Cf. fol.7v. Also see ch. 2, sect. c.

61 Cf. fol.7v.

62 See note 58, and fol.24r.

63 For the four pairs of antitheses discussed in this and the next three paragraphs see ch. 4, sect. c. For dense and rare see "Works", II, 243: 'Densi autem et Rari naturas alius ad copiam ad paucitatem materiae retulit; alius hoc ipsum elusit; plerique, authorem suum secuti, rem totam per frigidam illam distinctionem actus et potentiae discutiunt et componunt. Etiam qui illa materiae rationibus attribuunt (quae vera est sententia), neque materiam primam Quanto plane spoliatum, licet ad alias formas aequam, volunt, tamen in hoc ipso inquisitionem terminant, ulterius nihil quaerunt, neque quid inde sequatur perspiciunt ...' Also see ibid., III, 689.

64 Here Bacon implicitly contrasts the state of tangible matter in the earth's crust with its state in the earth's interior. In the interior tangible matter is devoid of spirit. Cf. fol.22r.

65 For explorations of the solid-liquid distinction see "Works", III, 25-8; "Abecedarium", op. cit. (ch. 1, 1), fol.41r-v.

66 For these fundamental, interconnected distinctions see ch. 2, sect. b, ch. 4, sect. d.

67 Cf. "De principiis atque originibus", "Works", III, 90: 'Talia enim corpora organica esse possunt, et veluti machina quaedam, quae etiam ex figura innumeras variationes nanciscuntur, qualia sunt corpora animalium et plantarum. Etiam in his ipsis, ea quoque quae organica non sunt, tamen si acutius introspiciantur, valde esse dissimilia reperiuntur. Quanta enim dissimilitudo inter partes animalium illas ipsas, quae vocantur similares? cerebrum, humorem crystallinum, albuginem oculi, os, membranam...' The force of 'compositae, et decompositae, et multipliciter compositae' is not entirely clear. A similar expression occurs in the "Novum organum", ibid., I, 330: 'Sunt enim motus et nixus corporum compositi, decompositi, et complicati, non minus quam corpora ipsa.'

68 Cf. fols.7v-8r. Also see ch. 4, sect. d; "Novum organum", "Works", I, 334. By motion 'versus homogeniam', Bacon is thinking of what takes place when composite bodies break down: dissimilar component parts separate, and then similar ones group together - as happens for example when milk and cream separate.

69 See fol.24r. For Bacon's views about the vacuum hypothesis see Rees, op. cit. (ch. 2, 9).

70 Cf. fol.8r.

71 Cf. fol.7r, and "Works", I, 350-2.

72 Cf. fols.7r, 8r.
73 For the significance of this list see ch. 1, sect. b. Also cf. lists on fols.20r, 20v, 30v.
74 See "Historia vitae et mortis", "Works", II, 220: 'Spiritus, si nec a corporis circundati antipathia irritetur, nec a corporis nimia similitudine pascatur, nec a corpore externo solicitetur aut provocetur, non tumultuatur multum ad exeundum.'
75 See note 73.
76 Cf. "Works", I, 310, II, 303.
77 Cf. ibid., II, 121: 'In Putrefactione spiritus non emittitur simpliciter, sed ex parte detentus mira comminiscitur; atque etiam partes crassiores non tam localiter contrahuntur, quam coeunt singulae ad homogeniam.'
78 See fol.12r.
79 See fol.29v.
80 See note 73.
81 Cf. "Abecedarium", op. cit. (ch. 1, 1), fol.39r-v, for a similar use of the 'sowing' metaphor. For Bacon's reservations about the status of his theories see "Works", I, 143-4; also see ch. 5, sect. c.
82 When Bacon refers to 'partes exsangues', he is no doubt thinking of the ultimately Aristotelian distinction between 'partes exsangues' and 'partes sanguines' - a distinction discussed by Telesio, op. cit. (ch. 5, 18), pp.491-500, 668-77. According to the "Historia vitae", "Works", II, 106, the 'partes exsangues' are the 'sicciores et porosiores.'
83 These doctrines are rehearsed in the "Historia vitae", "Works", II, 106-7. This paragraph was meant to stand just before the aphoristic section of the revised version of the De viis, see fol.8v.
84 For the first draft of material on this folio see fol.25r.
85 Cf. "Works", III, 58.
86 For parallels in Bacon's other writings see note 52.
87 See ch. 2, sect. b. For air and flame as 'pure' or 'free' pneumatic substances see "Works", II, 255.
88 See note 53; see also "Works", II, 213: 'Neque enim cava rerum tangibilium vacuum recipiunt; sed aut aerem, aut spiritum rei proprium ...neque rursus spiritus ille aer est (quemadmodum nec succus uvae est aqua); sed corpus tenue, cognatum aeri, at multum ab eo diversum...'
89 For the contrast between calx and powder see fol.10r.
90 Cf. "Works", II, 37.
91 Cf. ibid., II, 123-4.
92 Cf. "De augmentis", ibid., I, 599: 'Monemus, ut homines rite animadvertant et distinguant circa ea quae ad vitam sanam, et ea quae ad vitam longam, conferre possunt. Sunt enim nonnulla quae ad spirituum alacritatem, et functionum robur, et morbos arcendos prosunt; quae tamen de summa vitae detrahunt, et atrophiam senilem absque morbis accelerant.'
93 Cf. ibid., II, 372-5.
94 Much of the material presented on this folio first appeared in the "Cogitationes de natura rerum" (c1604), ibid., III, 24-5. Bacon's explanation of the action of cupping-glasses is also offered in the "Phaenomena universi", ibid., III, 711; "Novum organum", ibid., I, 351-2; and "Sylva sylvarum", ibid., II, 635.

95 This folio carries an early draft of the aphorism presented on fol.22r. Similar material is also to be found on fol.16r. For parallels in Bacon's other writings see notes 52-3, 85-8.

96 Cf. fol.16r, and "Novum organum", "Works", I, 311: 'Rursus, differentia illa spiritus, maxime nobilis et ad plurima pertinens, (viz. spiritus abscissi, ramosi simpliciter, ramosi simul et cellulati; ex quibus prior est spiritus omnium corporum inanimatorum, secundus vegetabilium, tertius animalium), per plurimas instantias deductorias tanquam sub oculos ponitur.' Also see ibid., II, 214-15.

97 For a discussion of vivification see fols.15v-15a r. As for the promise to speak of alimentation see ch. 5, sect. b.

98 This develops views set out on fol.16r. Also see note 56, and ch. 3, sects. a and b. For 'assimilation' see "Abecedarium", (ch. 1, 1), fols. 50v-51r.

99 The two aphorisms mentioned here are this and 'Aphorismus 1' (fol.22r). For the position that Bacon assigned to them see ch. 1, sect. b.

100 See "Works", II, 186 ff.

101 See fols.9v-10v, 11v.

102 Cf. fol.10v.

103 This folio carries an early draft of material on fol.29r.

104 Virgil, "Aeneid", Bk. viii, ll.481-8;

> 'quid memorem infandas caedes, quid facta tyranni,
> effera? di capiti ipsius generique reservent!
> mortua quin etiam iungebat corpora vivis,
> componens manibusque manus atque oribus ora,
> tormenti genus, et sanie taboque fluentis
> complexa in misero longa sic morte necabat.'

Bacon also alludes to Mezentius in similar contexts in the "Historia vitae", "Works", II, 106, and "Sylva sylvarum", ibid., II, 364.

105 'Omnia enim quae diximus...' Bacon is thinking principally of the activities of the inanimate spirits.

106 See fols.2v-3r, and note 104.

107 See note 58.

108 Cf. "Novum organum", "Works", I, 233-4. Also see Rees, op. cit. (ch. 2, 9), pp.569-70.

109 See note 21.

110 For Bacon's views on respiration see ch. 3, sect. c.

111 For alimentation see ch. 3, sect. c, ch. 5, sects. a and b.

112 Cf. fol.19v, item ν, and fol.20v item l.

113 Cf. fol.18r.

114 Cf. fol.19v, item κ, and fol.20r.

115 Cf. fol.19v, item λ, and fol.20r.

116 Cf. fol.20v.

117 Cf. fol.19v, item θ.

Translation notes

1 'Commentum' could be translated as 'invention' or 'opinion', but on the whole Bacon uses the word derisively. For examples of his use of the word see "Works", I, 164, 165, 169, 176, 291. 'Primigenii', cf. the translation offered by Pagel, op. cit. (ch. 5, 7), p.258.

2 'Atque hae ...' - this clearly refers not to the opinions of Telesio but to those of the radical moisture theorists.

3 In revising the draft, Bacon reduced three points to two which makes difficulties for the translator - difficulties overcome by conflating and recasting in translation.two of the interpolations which Bacon inserted into the amanuensis' draft.

4 For translation of 'refocillationes', cf. "Works", I, 340, IV, 225.

5 See note 25.

6 The phrase 'verificationem seu rectificationem', has a semi-technical meaning. Bacon is thinking perhaps of logical or methodological routines of the kind mentioned in the "Novum organum", "Works", I, 172, 268, 364.

7 Bacon is using 'fossilia' in its old sense to denote minerals or non-metallic refractory stones.

8 By 'simpler' and 'similar' Bacon means objects with little or no internal variety or structure.

9 The 'non minus' appears to reverse the intended sense so the negative has been omitted in translation.

10 Lit. 'beings which were in ...'

11 The word 'herbis' should of course be taken in its widest sense, i.e. to denote herbaceous as distinct from arborescent plants.

12 Lit. 'old supply'.

13 Lit. 'for hides'.

14 The Latin verb is singular but the sense seems to demand a plural.

15 Lit. 'opening', cf. "Novum organum", "Works", I, 317, 333.

16 The word 'theorema', which also occurs in the final paragraph of fol.11v, seems to denote a proposition which has yet to be proved. However this interpretation does not seem entirely comfortable given the confidence with which Bacon addressed the subject in the preceding paragraphs.

17 The word 'dewy' is a standard translation of the semi-technical 'ros', see ch. 5, sect. a.

18 The illegible word is no doubt a verb - perhaps 'care' or 'take pains about', but their Latin equivalents cannot be reconciled with marks in the manuscript.

19 See note 17.

20 'Instauratio' has no single English equivalent; it entails both the restoring of a (perfect) state which once existed, and the bringing about of a desirable state which has yet to exist.
21 See note 25.
22 See note 25.
23 The unmanageable Latin sentence has been recast as two English ones, and the parenthetical and interpolated remarks have been redistributed with, it is hoped, no significant loss of meaning.
24 It is assumed that 'admoneatur', though singular, refers both to 'similar spirit' and the 'mass'.
25 The expressions 'secundum homogeniam', and (further down on this folio) 'ad homogeniam' are, as it were, shorthand. Bacon is thinking of processes whereby mixtures (solid or liquid) separate out into their component parts; dissimilar parts move away from each other, and similar or homogeneous parts group together. For one of the translations used in the standard edition see "Works", V, 233.
26 Here the manuscript is very confused (see textual notes); it is assumed that 'in illis' refers to living bodies; if it refers to inanimate bodies then Bacon has reversed his apparent intended sense. In translation the words 'in inanimate bodies' have been added to supply the implied contrast.
27 For a similar use of 'praeparatio' see "Works", I, 248, l.13.
28 As far as this folio is concerned incomplete words in the Latin have been completed in translation.
29 Lit. 'continuous to itself'. Bacon is implicitly contrasting the channelled vital spirit with the discontinuous inanimate spirit; cf. fol.26v.
30 Lit. 'nor shall we digress seized by love of extraordinary instances'.
31 Lit. 'the differences and distinctions ... are two'; 'in animate' has been added to sharpen the contrast.
32 See note 29.
33 Lit. 'heat comes to the hand'.
34 Here as earlier in this paragraph 'animantia' (which would usually be translated as 'living beings') has been translated as 'animal bodies' in order to convey the animal-vegetable contrast.
35 Lit. 'which is the cooling <of the heat>'.