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INTRODUCTION  
TO THE PHILOSOPHER'S LABORATORY

This volume originated from a reading and research seminar on Roger Bacon's *Communia Naturalium* held at the SISMELE in the years 2009–2011. In order to approach such a complex and important author and one of his most extensive, multifaceted and relatively little investigated works, the *Communia Naturalium*<sup>1</sup>, we deemed it appropriate to bring together and compare different points of view and research experiences, to deal with the investigation in a new and deeper way.

This setting seemed to us similar to the requirement that Jeremiah Hackett had expressed quite directly in one of the pages of his volume *Roger Bacon and the Sciences. Commemorative Essays*: «It is important to gain some sense of Bacon's academic work as witnessed by his remaining authentic writings»<sup>2</sup>. Much work in this direction has been done by scholars who published their papers in that same volume and in the special issue of the journal «Vivarium» dedicated to Bacon in that same year<sup>3</sup>. However,

\* We gratefully thank Diana Catherine Bondonno for the generous help in revising our English text.

1. See *Communia Naturalium*, R. Steele (ed.) = Opera Hactenus Inedita Rogeri Baconi (henceforth OHI), Fasc. II–IV, Oxford 1911 (henceforth CN). Since page numbering is continuous in the three volumes (vol. 2 starting at 138, vol. 3 at 308), we shall give only page numbers in the footnotes.

2. See J. Hackett, *Roger Bacon: His Life, Career and Works*, in Id. (ed.), *Roger Bacon and the Sciences. Commemorative Essays*, Leiden 1997, 21.

3. See the essays issued in *Roger Bacon and Aristotelianism* = «Vivarium», 35, 2 (1997). New attention has been brought very recently on Bacon's attitude to Aristotle and on his early *quaestiones* by L. Bianchi, *Couper, distinguer, compléter: trois stratégies de lecture d'Aristote à la Faculté des arts*, in *Les débuts de l'enseignement universitaire à Paris (1200–1245 environ)*, eds. J. Verger, O. Wei-

much remains to be done, in view of an extensive and detailed contextualization of Bacon's research and doctrines as a whole, not only of those that stand out for their originality (*scientia experimentalis*, optics and the doctrine of *species*, as well as his focus on frontier topics in medicine and alchemy). Such a need is clear also from the historiographical survey by Amanda Power, who in tracing the history of the Renaissance and modern fame of Bacon, noted that his reputation as a «magician» and initiator of the «experimental science» has delayed a correct setting of the studies on his works: «The study of Bacon has been hindered to an unusual degree by being conducted outside the appropriate historical context»<sup>4</sup>. CN are certainly one of the Baconian writings that mostly suffered this type of approach, being in fact one of the least studied, although often used and quoted in studies about other works of Bacon.

In 2009, therefore, we decided to tackle the study of this work. We invited a group of Italian scholars of Medieval thought, linked by methodological affinity although devoted to research on different topics, to work together on a research aimed in the first instance to highlight issues and/or parts of the text which might prove of particular relevance, according to the different points of view that research interests, experience, and the sensitivity of each one allowed to grasp.

The team's work over the next two years started from a reading of CN by all the components of the group, followed by several sessions of common discussion. At this stage we focused on several issues, considered to be important for delineating an overall, though not exhaustive, presentation of CN, as well as suitable to be dealt with according to the specific research interests of each member of the team. During this work a clear perception emerged that we had set foot in the intellectual labora-

jers, Turnhout 2013, 133-52; and S. Donati, *Pseudoepigrapha in the Opera hactenus inedita Rogeri Baconi? The Commentaries on the Physics and Metaphysics*, ivi, 153-203. We warmly thank both Luca Bianchi and Silvia Donati for sending us pre-prints of their essays.

4. See A. Power, *A Mirror for Every Age: The Reputation of Roger Bacon*, «English Historical Review», 121 (2006), n° 492, 658; Ead., *Roger Bacon and the Defence of Christendom*, Cambridge 2013.

tory of the philosopher, as if we could see him building his own conceptual tools, in a close dialogue and often in opposition to the more classical and philosophical *auctoritates* and to the *magistri* of his time. The topics we have chosen to examine have indeed made it possible to check the validity of a statement by Lynn Thorndike, who wrote that the writings of Bacon «give a most valuable picture of Medieval thought, summarizing, it is true, its most advance stages, but also including much that is most characteristic, and even revealing some of its back currents»<sup>5</sup>.

This overall interpretation of CN as a container, in which ideas and intellectual needs of Roger were elaborated and compared to materials of the philosophical tradition and contemporary debates, has been acknowledged in the title of the book.

The seminar was hosted in the premises of the Certosa del Galluzzo, made available by the President of SISMEL Agostino Paravicini Bagliani, who has fostered the work of the seminar and whom we want to thank here. In its final stage the seminar also saw the participation of Jeremiah Hackett, whose studies on Roger Bacon are internationally renowned. To the Chairman of the Istituto di Studi Umanistici our thanks for having hosted the «Giornata di Studi Internazionali» held on 5 October 2011 at Palazzo Strozzi, in Florence, which concluded the seminar and whose proceedings are hereby published.

The large text of *Communia Naturalium*, edited by Robert Steele in the volumes II-IV of Roger Bacon's *Opera hactenus inedita*, is divided into books, distinctions and chapters<sup>6</sup>, as Bacon himself declares at the beginning of the third distinction of the first book:

Postquam in prima parte huius libri primi de Communibus naturalium determinatum est de efficiente naturali, et in secunda parte de materia et universaliter de causis naturalibus, nunc in hac parte tercia

5. See L. Thorndike, *A History of Magic and Experimental Science*, New York – London 1964, II, 618.

6. About the relationship between the edition and the manuscript tradition, see, in this same volume, the essay by Roberto Lambertini and Romana Martorelli.

dicendum est de motu, et hiis que pertinent ad ipsum. Nam, cum determinatum sit de causis naturalibus, et natura est principium motus, consequens est ut fiat sermo de motu et eis que ipsum comitantur<sup>7</sup>.

This statement is the closest to an index that can be found within the text, although it does not fully reflect the partition offered by the F manuscript and given in apparatus by Steele<sup>8</sup>. It is neither placed at the beginning of the work, nor does it include all the topics actually dealt with therein: in particular, it does not mention the fourth part of the first book *de productione rerum in generali*, i.e. about generation; nor the second book *de celestibus*<sup>9</sup>. Therefore it is better understood as a clarification in the course of work, which provides some useful data about its structure.

The prologue puts forth the structural elements of the entire writing; for this reason we will devote particular attention to that in our introduction. The thematic blocks actually developed in the subsequent parts of the first book (the one that is dedicated to *communia*, which occupies two volumes – OHI II and III – of Steele’s edition) are: the agent, in respect of which the author recapitulates certain parts of his doctrine of *species* and *perspectiva*; matter and form; the relationship between universal and individual; natural causes; motion with its *concomitantes* (void, time and place), the generation of substantial form, of the elements, of mixed bodies, of plants, animals and humans (with a wide digression, almost a treatise in itself, about the human soul), and finally the generation of monsters. The second book, of lower amplitude (equivalent to approximately one-third of the

7. CN, 138.

8. See CN, 1: «Hoc est volumen naturalis philosophie in quo traditur sciencia rerum naturalium secundum potestatem octo scienciarum naturalium que enumerantur in secundo capitulo. Et habet hoc volumen quatuor libros principales. Primum est de communibus ad omnia naturalia, secundum de celestibus, tertium de elementis et mixtis inanimatis, quartum est de vegetabilibus et animalibus. Primus liber habet partes quatuor. Prima pars habet distinctiones quatuor. Prima distinctio dat intencionem et numerum scienciarum nobilium et modum procedendi, et explicat in universali rationem materie et efficientis et secundum hoc quatuor habet capitula quatuor, et in primo datur intencio».

9. See CN, 240, 309.

edition as a whole), is instead a monographic treatise *de celestibus*, dedicated to the specific treatment of heavenly bodies (*de corporibus, de figuris celi et mundi, de mundo* etc.).

The text seems to be incomplete with respect to the project Bacon had in mind: indeed, in the opening pages we see that the author aspired to compose a unitary and tightly structured writing, where specific treatises had to be orderly placed according to the plan of an all-encompassing book (that might possibly correspond to the *Scriptum principale*, mentioned in CN only once)<sup>10</sup>. This notwithstanding, Bacon is continuously tempted to introduce digressions from his main *intentum*, as both the whole text and the individual chapters and divisions are considered<sup>11</sup>. He does so «for the greatest admiration of readers»<sup>12</sup>. Remarkably, a similar aspiration to a unified and well-organized order as the ideal of philosophical writing was also clearly expressed by Bacon at the onset of *Communia Mathematica*, on which CN is modelled<sup>13</sup>.

The double tension – wavering between the desire for an orderly unity and specialistic digressions, between a comprehensive plan and free excursus – characterizes the entire structure of the text as well as its setting, which is only partially unitary as the author desired, and has not been completed. The same tension underlies the actual dispersion of the parts, which are arranged in a somewhat «horizontal» and detailed order, crossed by insistent attempts to an overall «vertical» organization. It also explains the

10. See CN, 105.

11. See the many pages where Bacon sketches discussion about different items (e.g. about elements in the *de celestibus*), that in the prologue he announced as specific treatises and that – as he repeatedly confirms – will be better developed *in locis propriis*. Often these «proper places» are not the ones announced in the prologue, neither are they presented according to the planned order.

12. CN, 366: «[...] nunc iuxta hoc volo quoddam incidens determinare, quod licet non sit de principali intencione, tamen in maiorem admirationem contemplatores eius adducit quam intentum principale, et ideo dignum est fieri de hoc consideracionem»; see also above, note 8.

13. *Communia Mathematica*, R. Steele (ed.) = OHI, Fasc. XVI, Oxford 1940 (henceforth CMath), 1: «Sic autem per totum istud volumen sicut in aliis meis voluminibus philosophie volo observare ut partes et distinctiones et capitula cum expressione brevi eorum que in illis continentur prescribantur [...]».

variable size of the parts themselves, as well as the relationships with other of Bacon's writings, that appear throughout the pages, or that the author himself explicitly suggests.

Although we can not entirely exclude the composition over an extended period of time (i.e., according to some scholars, 1260–1292/4)<sup>14</sup>, we believe that the formulation of the project and a good part of its realization runs parallel to the drafting of the three *Opera* written and sent to Pope Clement IV in 1267. Therefore we agree with the opinion repeated several times by Steven Williams, according to which CN would be placed precisely within the years 1260 to 1270, that see the composition and dispatch of the three writings *praeambula*<sup>15</sup>. Several themes are discussed both in the three *Opera* of 1267 and in CN, but – it seems – with one important difference. The explicit intent of Bacon in his *Opera* is programmatic, often very controversial, and aimed at raising a decisive renewal of forms and fields of knowledge and of its organization, of the mutual links between the sciences and of their connection with the purpose of the *Renovatio* of Christianity. In the works sent to the Pope there are many tirades against the current social and spiritual condition of the Church and of Christian people; blazing critical words on the degradation of *Respublica fidelium* and its pastors; heavy recriminations about the painful condition of the schools and the incompetence of Christian doctors, who in the eyes of Bacon were so little truly learned.

On the contrary, polemical overtones and purposes are almost entirely absent from CN. Indeed, Bacon did not refrain from critical discussions and exhortations, but they are mostly critical considerations concerning specific doctrines and interpretations, assessment and possible reformulations of theories, in which he often remarks on his own difficulties and admits that he had doubts and even changed his mind<sup>16</sup>. One has the impression of

14. See Hackett, *Roger Bacon*, 22: «The dating of the *Communia Naturalium* is very problematic». Cf. also Id., *Bacon, Aristotle, and the Parisian Condemnations*, «Vivarium», 35, 2 (1997), 284–85, esp. note 6.

15. See S. Williams, *Roger Bacon and the 'Secret of Secrets'*, in Hackett (ed.), *Roger Bacon and the Sciences*, 366.

16. Cf. CN, 69: «Et estimatum est a multis, et ego diu credidi hoc quod in aliquo genere tercio inveniantur hec tria [...]».

a lively exchange between scholarly perspectives, and of a critical but constructive dialogue with the main *auctores*, much discussed and yet fathomed and respected. In CN Bacon's project is thus consistent with his reform project, yet it is more quietly and openly oriented to fill the innovative schemes proposed in the *Opera* with doctrinal contents. He wanted to explore the possibility of formulating specific and detailed natural doctrines, following a systematic order that does not undermine the Aristotelian one, but reshapes it according to Bacon's new needs, and develops into a constant debate, often but not always controversial, with the *auctores* of Scholastic natural philosophy.

This style is stressed by the attributions through which, here and there in the text of CN, Bacon designates the tone of his investigation and speech: he intends to proceed «secundum viam inquisitionis, magis quam determinationis et deffinitionis alicuius sentencie, et sine preiudicio melioris sentencie [...]»<sup>17</sup>; a topic (an alchemical one) is announced, but only to the extent that «presens persuasio requirit», since deepening it would move away from the «series istius persuasionis»<sup>18</sup>. Roger sets out an investigation and *persuasio*, a speech that is relaxed yet controlled, an open discussion: a style fitting to a work that is both a doctrinal survey and a research account. We are faced with a structured and organized working plan, a unitary purpose to be achieved, although its realization does not always respect planned stages and intent, even if it takes them into account. Bacon intends to write a text that is foundational and exhaustive as far as research in the sphere of natural philosophy is concerned, exposing in detail both standard contents and open problems of this field of knowledge. The work he is approaching will complement the *Communia Mathematica* and the other already issued writings on logic, grammar, geometry and optics/*perspectiva*.

These are the author's intent; clearly, though, as also happens on other occasions, the planned arrangement gets out of control, goes beyond or shrinks against the announced schema, or is intertwined with discussions already carried out. These changes can occur due to lack of time<sup>19</sup>, to the excessive detail of clus-

17. CN, 299.

18. CN, 275.

19. This problem is mentioned in CN, 198-99, 289.

ters of issues, or to the major and unexpected importance that certain foundational parts take in the written scrutiny. Hence the impression that the reader gets, of a constant wavering from a unitary view, to which Bacon often refers, and his attention to specific topics; from a tight view of the ensemble and the many digressions to which an issue may lead; from a systematic arrangement of doctrines opening with general information and developing towards more precise issues, to metonymic associations and paratactic lists. Therefore CN appear as a research work actually structured in modules and consisting of thematic sections, some of which are more developed, and some less, depending on their being treated in other works – either finished or still in progress. They are implemented by the frequent use of materials that match, or refer back to, different sections or pages of Bacon's other works, or that will be re-used in them (the more specific and recurring references are to the *Communia Mathematica*, to the *Opus Majus*, *Minus* and *Tertium*, and to the *De multiplicatione specierum*. See Table 1).

We are actually in front of what we have called a «philosophical workshop» – research and compilation –, strongly project-oriented, foundational, and at the same time reaching out to use, remake and recirculate what has already been done and achieved, though with corrections and additions. Thus, on the one hand, Bacon sometimes refrains from going into details of issues that have been already and best treated before, or in other works<sup>20</sup>, and that are too specific and inappropriate. On the other hand, however, he states that every doctrinal subject is appropriately placed *in locis propriis*<sup>21</sup>, each notion and topic having its pondered place in the epistemological scheme and in the plan of the book. He emphasizes the fact that in his exposition he is following a predefined index<sup>22</sup>. Furthermore, although stating his will not to go into too specialized treatments («non enim intendo hac vice scribere eciam tractatus de singulis scientiis naturalibus»)<sup>23</sup>,

20. See CN, 105: «Exposui aliis temporibus retroactis»; CN, 298: «Nam in aliis consideracionibus meis certificavi de hiis set non habeo scripturam ad presens».

21. CN, 10.

22. See esp. CN, 112-19, dense with references to other parts of CN itself.

23. CN, 13.

Table 1

Title	page	written	announced	notes
<i>Metaphisica</i>	1		–	
	3	–		
	16		–	
	17	–		
	18	–		
	38	–		in tractatu meo <i>de speciebus</i> metaphisico; see also 42: Multa alia sunt circa istas multiplicaciones que magis ad methaphisicum pertinent
	43	–		<i>Perspectiva</i> is also cited, cf. below
	44	–		
	51	–		
<i>Moralis philosophia</i>	182	–		
	1		–	
	128	–		
	287	–		
<i>Scriptum principale</i>	105		–	
<i>Opus Majus</i>	231	–		
<i>Opus Minus</i>	274	–		in tractatu alkimie speculative
<i>De speciebus*</i>	38	–		in tractatu meo <i>de speciebus</i> metaphisico, cf. above
	65	–		
	103	–		
	104	–		
	289	–		
	13		–	
	43	–		<i>Metaphisica</i> is also cited, cf. above
	103			
	297			
	300			
<i>Communia Mathematica</i>	155	–		
	321	–		
	341	–		
<i>Mathematica</i>	1	–		
	6	–		
<i>Methamatica</i>	3	–		
	5	–		
<i>Arismetica</i>	339	–		
	316	–		
	336	–		
	341	–		
<i>Commentary on Euclides (?)</i>	322	–		ad ea que exposui super septimam decimam Elementorum Euclidis
	340	–		Et manifestavi super undecimum librum Elementorum Euclidis

\* The title *De speciebus* refers sometimes to *De multiplicatione specierum*, and sometimes to the section on the *species* in CN, 24-46. We have tentatively distinguished between them: in this Table we have listed references seemingly referring to *De multiplicatione*, in Table 2 references to the above mentioned section of CN.

he announces, from the very first pages, the specialist treatises to which he refers several times in the course of CN, using the term *tractatus*. Again, if, on the one hand, Bacon points to the core foundation of each doctrine, «medullarem substantiam omnium scienciarum»<sup>24</sup>, on the other hand he pursues the idea of an all-encompassing unitary discussion<sup>25</sup>.

These two aspirations do not contradict each other in principle, and together they animate and substantiate the proposed reform of learning announced in the three *Opera*, which needs to achieve depth and totality; certainly, however, they make the ordering and structure of CN difficult to display. Indeed, these pages are neither private notes, scattered and disconnected, nor a medley, but nonetheless they don't offer a fully defined and refined work. They are protocols and results of a philosophico-scientific research, a doctrinal assessment in progress, truly the philosopher's laboratory files. Surely this is not yet the *Scriptum Principale*, the renewed encyclopedia of knowledge announced in the *Opera* of 1267, or, at least, it does not thoroughly implement it. Indeed Bacon just says in CN that «ideo supersedendum est donec fiant scripta principalia»<sup>26</sup>. For the author this definitive and complete work will remain a mirage<sup>27</sup>, or rather a regulative idea that frames and propels all of his writings after 1260, as their goal; but one can certainly believe that in Roger's view CN could be at least a partial discussion of some of its sections, an important part of that final work, that had not yet been undertaken by anyone, and that he always proposes as his final achievement.

24. CN, 10.

25. See CN, 13: «[...] decrevi in hoc opere colligere de omnibus scientiis naturalibus» and «volo reducere in unum»; CN, 10: «[...] medullarem substantiam omnium scienciarum in hoc volumine ponam que nusquam posita est adhuc in uno volumine».

26. CN, 105. Bacon defines *Scriptum Principale* the encyclopedia still to be written, and announced to Clement IV in the *Opera*; these are on turn defined *Scripta Preambula*: cf., among others, F. Alessio, *Introduzione a Ruggero Bacone*, Bari 1985, 9.

27. Perhaps a hint to this overall work is also in CN, 298: «Nam librorum perfectorum composicio habet hec expedire»: the content of the «perfect books» should include and reconsider issues already dealt with in the alchemical writings here alluded to; however, they are not included in CN.

This character of CN is first signalled in one title, that seems to designate this text best. Bacon uses several terms to indicate his natural work in progress: *volumen*, *opus*, *Naturalia*<sup>28</sup>, but in the *Tractatus de celestibus* describes it as a whole as *Compendium philosophie*<sup>29</sup>: a compendium of natural knowledge which is of a philosophical character, all-encompassing and consisting of theoretical reflections and/or critics about more or less general aspects of nature. In the context of the desired encyclopedia it would be the third part.

All this is already clear when reading the «prologue»<sup>30</sup>, the programmatic and descriptive introduction by which Bacon opens and structures the text of CN and outlines the organization of this work as his «philosophical workshop». The form in which we read this introductory pages might have been written in retrospect, but they undoubtedly expose what had been the program-project since the conception of the work. Bacon defines CN as an original work, whose novelty he emphasizes. Indeed, he states that this knowledge has never been gathered before in a single volume, and that he also intends to consider those issues «que in operibus aliis non sunt tractata»<sup>31</sup>.

The main themes developed, and therefore the guidelines of the treatment set out in this introduction, concern: 1) the survey of all sciences and the articulation of knowledge, i.e. an epistemological consideration, interwoven with the enunciation of the major doctrinal themes of the work, that Bacon is just beginning to write, and its partitions, 2) the research methods and the stylistic choice that Bacon intends to follow and implement here.

As far as the first point is concerned, Bacon begins by announcing a plan or general index of the full and final book to be composed: this plan is based on an epistemological structure, and it partially refers to something that has already been written.

28. For the title *Naturalia*, cf. CN, 5, 9, 27, 316; for *Communia Naturalium*, cf. CN, 50, 108, 138, 316, 371; cf. also CN, 126: «in prima parte huius operis»; CN, 240: «In hac igitur parte huius primi libri naturalis voluminis».

29. Cf. CN, 316, 342. The details of this «compendium» are announced in the prologue (see here below).

30. The term is used by Bacon himself, when he refers to the partitions announced «in prologo istius Compendii Philosophie» (CN, 342).

31. CN, 10, 65.

Indeed, after the parts on grammar, languages, *logicalia* and mathematics (all foundational, though for different reasons), it is now time to face («nunc tercio occurrunt») <sup>32</sup> *Naturalia*; the books on *Metaphisicalia cum Moraliibus* will follow. At this point, the author lists *naturalia* – «*sumpta specialiter et stricte*» <sup>33</sup>; such «objects» constitute the ontological layer where the principle of motion and rest is effective. They are arranged in a series of increasing complexity, as far as composition, articulated movement and mutual dependence are concerned: i.e. elements, inanimate bodies, plants, animals (beasts and men), celestial bodies <sup>34</sup>. If *multe scientie* are to be established, in order to understand these natural beings, it is nonetheless necessary that there be a foundational science in the general plan of knowledge, «*magna scientia de communibus naturalibus*» <sup>35</sup>, very difficult but quite useful. It will be structured on the model of *Communia Mathematica*, which had been composed before the special parts of mathematics were treated individually.

After having arranged and well articulated the ontological status of natural beings and the level of knowledge referring to them, Bacon introduces a third level, this one properly doctrinal <sup>36</sup>: does not a similar science already exist within the Aristotelian encyclopedia, i.e. «in scientia naturali vulgata apud Latinos» <sup>37</sup>, and especially within *Physica*? On closer examination, however, Roger notes that Aristotle certainly followed a pattern similar to what he himself is planning – and this is a warranty of the solidity of his own procedure –, but that Aristotle’s work is burdened by significant defects, excessive vagueness and lack of in depth analysis of key issues. On the one hand Aristotle, in the special partitions of his natural books, often focused on *conclusiones* too *communes*, on *universalia*, «et nihil docet in particularibus» <sup>38</sup>: this is clear from an examination of the Aristotelian treatise *De caelo*, and almost everywhere in his other books on nature («sic fere ubique in aliis libris naturalibus») <sup>39</sup>. On the other hand, the Greek philosopher treats too *imperfecte* some of

32. CN, 1.

33. CN, 2.

34. See CN, 2.

35. CN, 4.

36. For this overall survey of Aristotle’s natural philosophy, his *libri naturales*, and their limits see CN, 3-5.

37. CN, 3.

38. CN, 4.

39. *Ibid.*

the *communia*, that are indeed of the utmost urgency: Aristotle's natural philosophy in fact «parum de hiis que ad materiam pertinent certificat [...] et minus de forma, minimeque de agente»<sup>40</sup>.

Evidently Bacon thinks that the discussion of these issues in the Aristotelian *Metaphysics* and elsewhere is too «separate» and does not fully meet the foundational and instrumental requirements of these principles in naturalistic research. However, it is these aspects precisely that «sunt communia omnibus naturalibus», and will therefore be the the firm ground of a *scientia naturalis* that will be «prima inter ciencias naturales»<sup>41</sup>. Following this, seven special sciences will take place: *Perspectiva* («prima specialis scientia inter ciencias naturales»), *Astronomia*, *Scientia ponderum*, *Alkimia*, *Agricultura*, *Medicina*, *Scientia Experimentalis* (later correctly mentioned as eighth, and distinct from the others because of various prerogatives)<sup>42</sup>. Needless to say, Bacon also enlarges and finely articulates the internal partitions and details of objects relative to each of the seven special natural sciences<sup>43</sup>. CN neither follows this order, nor does it include this series of sciences, so that in what follows, rather than considering the special sciences, the author will focus on their principles, arranged according to the order of natural things<sup>44</sup>. Moreover, these entities (*res naturales*) are not listed from simple to complex, but contrariwise, starting from astronomical objects (*De celestibus*), because the impulse of motion – of the different types of motion – that characterizes the natural layer of reality proceeds from them.

Thus Bacon presents three principal patterns, and interweaves them: one is the pattern or plan of an overall work ranging from grammar to moral, partly written and partly still to be written. Perhaps – as we have already mentioned – Bacon alludes to the *Scriptum Principale*, that he always had in mind: he illustrates its hierarchical structure and outlines the functional links among the large special sections that should compose it<sup>45</sup>. Then he locates in this plan an independent area of research and teaching, and therefore the need for a separate discussion and a full and spe-

40. CN, 5.                    41. *Ibid.*                    42. See CN, 9.

43. For these internal details of the sciences, see CN, 6-9.

44. CN, 5-6: «secundum seriem rerum naturalium».

45. See CN, 1.

cific book as yet unwritten, dedicated to the contents of the natural sciences, whose provided list is generally corresponding to the partition of sciences given in the *Opera* of 1267. But the principles of these sciences, which correspond to the order of the real entities defined by natural motion, must be investigated apart, in dialogue with the philosophical tradition, although CN have not been written as a support for university teaching.

It is therefore necessary to make a comparison with the Aristotelian encyclopedia, which allows Bacon to clarify the difference between *naturalia* (the objects of special sciences) and *Communia Naturalium* (the principles of the partitions of reality). He does this also in order to avoid the mistakes that weaken the apparently similar enterprise of Aristotle, that is only partially parallel to Bacon's. A thorough examination must be developed of what is common to all *naturalia* (form, matter, agent, universal/particular relationship, cause, motion, generation), in order to get a firm ground upon which the peculiarities and the manifestations of these principles can be articulated into individual parts, that will be analyzed in specific treatises (heavenly bodies, elements, living bodies).

As regards the characteristics and relationships of these epistemological and common principles and those of individual sciences, Bacon claims to have written a «magnum tractatum in Methaphisica, cuius proprium est distinguere omnes sciencias, et dare rationem universalem»<sup>46</sup>. Robert Steele in his introduction to *Metaphisica de viciis* identifies this treatise with the missing part of the work already mentioned and quoted in *Opus Majus* as «scientia [...] de illis quae omnibus rebus et scientiis conveniunt»<sup>47</sup>. A similar and more detailed definition appears at the beginning of *Communia Mathematica*, the text that Bacon indicates as a model of the work which is now about to be written:

Necesse est omni tractanti de scientia quacumque speciali ut eam aliis eque sepius comparet ad scientiam communem omnibus quae methaphisica nominatur; cuius proprium est dare divisionem omnium

46. CN, 9.

47. *Opus Majus*, vol. 2, chap. 18, 75.

scienciarum [...] et differentiam et originem, et quod est proprium cuiuslibet, et ordinem illatum assignare [...] et verificare principia illarum<sup>48</sup>.

Under the title of *Metaphisica*, therefore, Bacon sometimes refers to a still unwritten work, sometimes to *De multiplicatione specierum* (maybe even to the initial part of the same CN on the *species*), and in some other passages to *Metaphisica de viciis*.

His declarations of intent in the prologue, as well as the descriptions and organization of the sciences here proposed, already make the structure of the planned work remarkably complex, i.e. the structure of this third book about *naturalia*, which is in turn placed into a broader context, this too already planned. Even more complex – and often of poor outcome – is the attempt the reader makes to match the list of planned parts with those actually written by Bacon. Truly, one manuscript of the *Communia Naturalium* shows an articulation of the «volumen philosophie naturalis in quatuor libros»; yet these four books do not appear to fully correspond neither to the partitions here listed in the introduction/prologue, nor to the citations of various parts of the work, made by Bacon himself within it<sup>49</sup>. Of course, many of the planned sections (often referred to in the text as *tractatus*) are announced and then scattered in different places (e.g. the treatise on the elements), or they enter as digressions and examples in a place different from where they should be according to the designed order. Such is the case of the treatise on humans and human soul, that we find in CN but without the breadth and extension to be expected for a *tractatus*; or of agriculture, hardly hinted at within the limited section on plants. Some of the seven *scientie speciales* are mentioned, but for them – e.g. in the case of alchemy – Bacon refers to what he has already written in other texts. The *tractatus* carried out more fully appears to be only *de celestibus*; to this we can perhaps add the *tractatum compendiosum de perspectiva* developed in the first part, which owes much to *De multiplicatione*.

48. CMath, 1. See also the Introduction and Appendix by Robert Steele to his edition of *Metaphisica Fratris Rogeri ordinis Fratris Minorum. De viciis contractis in studio theologie*, OHI, I, Oxford 1905, III-V and 53–56.

49. CN, 1, 1–3. See text here in correspondence with the notes 7–8 and esp. the passage cited at note 8, 6.

The previous considerations confirm the ambitious and all-encompassing purpose of this text and its careful planning<sup>50</sup>; yet, at the same time, its actual structure shows a compositive process still *in progress*, with parts more or less developed and often disjointed; therefore, the nature of this work is that of a book *in fieri*, not yet completed and refined. This is so, notwithstanding the undoubted efforts, visible everywhere and accurately reported by Bacon, intended to refer to what has already been written, to update themes developed elsewhere and now newly tackled, and to cite and link parts, sections and books, in an attempt to connect the whole in a unified plan. Table 2, which presents the references to individual sciences and/or *tractatus*, enables the reader to understand this endeavor.

In the prologue, after the analysis of the different schemes variously structuring the following text, a notable passage about method is also introduced, «de modo procedendi in tractando de naturalibus»<sup>51</sup>. These are perhaps among the most contentious pages of CN<sup>52</sup>, and contain further statements, respectful but sharp, about the limited utility of Aristotelian natural philosophy and the defects of the approach to it by Latin scholars.

As we have seen, Bacon intends to compose a compendious work (*compendiosum tractatum*) on the model of *Communia Mathematica*:

Sicut igitur ad compendium congregavi vim et potestatem scientiarum mathematicarum, resecatis superfluitatibus infinitis et additis que omissa fuerunt ab antiquis: sic in naturalibus procedam<sup>53</sup>.

«To make a compendium» does not here mean to compile indefinitely, possibly summarizing, but to select, aggregate and add critically, according to an open but structured plan. The aim is *plurima compendium moderari*, avoiding the spread (*effluere*) of superfluous considerations, which are unnecessary because now

50. CN, 10: «[...] medullarem tamen substanciam omnium scientiarum in hoc volumine ponam que nusquam posita est adhuc in uno volumine nec tantum de potestate sapientie naturalium scriptum est adhuc in omnibus libris Latinorum [...]».

51. CN, 10.

52. See CN, 11–12.

53. CN, 10.

Table 2

Title	page	written	announced	other	notes
<i>De speciebus</i>	215	–			
	274	–			
	203	–	–		The author also refers to an unwritten treatise <i>de elementis</i>
	204	–			Cf. above
<i>De radiis</i>	272	–			
<i>De elementis</i>	6			–	
	194		–		in tractatu quarto: according to the partition in ms. F, and to that of the edition (cfr. 138), the treatise on elements should be the fourth
	203		–		Two references to <i>tractatus specierum</i> , cf. Table 1
	206		–		
	211		–		
311		–			it might refer generally to a subject to be discussed
<i>De raro et denso</i>	213		–		
<i>Tractatus quartus</i>	194		–		
<i>De plantis et animalibus</i>	7			–	
<i>De nutrimento et augmento</i>	207		–		
<i>De spiritibus</i>	298		–		
<i>Quintus liber</i>	116		–		it is clearly a reference to the treatise
					on animals, yet, according to the partition in ms. F and to that of the edition, this should be the fourth treatise, not the fifth
	119		–		
	122		–		
<i>Alkimia</i>	6			–	
	274	–			scilicet in <i>minori opere</i>
<i>De homine</i>	7			–	que dicitur medicina
	8			–	de animali rationali
<i>De celestibus</i>	117		–		de motu celorum [...] in tercio libro: reference to <i>de celestibus</i> as third book does neither correspond to the partition in ms. F, where it is said to be <i>secundus liber</i> (CN, 309), nor to the edition, where it is book II
	194		–		celum [...] dicitur in tercio libro: cf. above
	219		–		
<i>De causis</i>	220	–			
<i>Scientia experimentalis</i>	9				
<i>De efficiente</i>	113	–			
<i>De substantia</i>	142	–			Defined «chapter», not «treatise»
<i>De infinito</i>	150		–		This is probably a chapter from <i>de celestibus</i>
<i>De tempore</i>	150			–	aggrediens igitur
	163	–			Here defined «chapter», while previously it is referred to as «treatise»
<i>De agentibus</i>	271	–			
<i>De vacuo</i>	379	–			Defined «chapter», not «treatise»

superseded by history, considerations which not even Aristotle could avoid, and in which he is not to be followed (since Aristotle «multa respectu nostri temporis cumulavit superflua») <sup>54</sup>. Later, when this kind of compendium is completed, it will be possible to treat each section separately in a more ample and relaxed way (the many *tractatus* <sup>55</sup> announced or implied by Bacon in the course of the text, not always presented in the prologue and often undeveloped), or otherwise to support the further development of research, that Bacon paved the way for. Thus research shows itself to be open and progressive also in this sense <sup>56</sup>, without falling into the error of those who, tackling and using Aristotle, «exceed in amount» and are incapable of limiting themselves *in necessariis*, so that they compile «vanissima et errores multiplicantes infinitos» <sup>57</sup>. Above all, Bacon states that the natural encyclopedic knowledge itself, the «libri naturales et vulgati», – whether written by Aristotle or by other scientists – can not really be understood without all other seven special sciences, and especially without mathematics («sine aliis septem scientiis specialibus, nec etiam sine mathematicis») <sup>58</sup>, i.e. without the indispensable knowledge that he has listed in the previous paragraphs

54. *Ibid.* Elsewhere Bacon defines the correct critical attitude towards Aristotle, writing that the Philosopher took into account the opinions of his times, but that they are *absurda*: «ideo non oportet nos, querentes mentis soliditatem, imitari Aristotelem in omnibus, sicut a principio huius voluminis explicavi» (CN, 150); moreover, he thinks that Aristotle is sometimes elusive, «non enim singula in singulis locis explicat» (CN, 271). Other considerations on the difficulty of interpreting the natural and metaphysical works of Aristotle and his commentators can be found in a page where Bacon, following Cicero, affirms that the ancient philosopher's writings had also secret versions, whose knowledge could somewhat change the current interpretations of his doctrines: «Sic enim Aristoteles [...] edidit vulgatas scripturas de partibus philosophiae preter illas quas in armariolis retinuit sinceriora sapientiae secreta, ut vult Tullius 5<sup>o</sup> *Achademicorum* libro» (CN, 249).

55. *De et raro et denso*, CN, 213; *De tempore*, CN, 150; *De efficiente*, CN, 113; *De agentibus*, CN, 271.

56. CN, 10: «[...] ut si necesse fuerit alias copiosius tractem singula aut quod alii per me excitari per mea promoveantur a maiora»; see also CN, 13: «Quibus factis [the treatises *compendiose per ordinem in celestibus, et sic de elementis, et per simile de mixtis, ita et de omnibus, usque ad ultima naturaliter generata*], si opus est dare scientias naturales singulas in forma propria, vel ego procedam ad hoc, vel alii per labores meos poterunt excitari».

57. CN, 11.

58. *Ibid.*

and has partly developed and proposed (or is developing and proposing) in the *Opus Majus*, *Opus Minus* and *Opus Tertium*.

It appears, then, that the doctrinal achievement offered by the Baconian book on *Naturalia* is to be understood partly as an essential compendium of natural knowledge (which reveals the roots, extracts and collects the *medulla*), and partly as an indispensable approach to other books on naturals, those of Aristotle beyond (and maybe before?) those of Bacon's own «new science». Bacon explains this point «historically» as well as controversially<sup>59</sup>. At his time, indeed, – he notes – Aristotle's logic is quite well mastered, having been known for at least fifty years; yet the same is not true – for various reasons, including Roger's usual remarks about bad translations and the continuing lack of important books – for *philosophia naturalis*, which «vix a triginta annis lecta est, et a paucis viris, a quibus scripta non sunt facta»<sup>60</sup>. Even those who have devoted great care and passion to this, «videntes quod per textum Aristotelis et commentatorem suum non potuerunt scire naturalem philosophiam, convertuntur se ad alias sciencias naturales septem et ad mathematicas, et alios autores naturalis philosophie [...] et sic pervenerunt ad noticiam naturalium, de quibus Aristoteles in libris vulgatis et eius expositor non possunt satisfacere studio naturali»<sup>61</sup>.

This task of more systematic collection – also carried out from the texts of Aristotle and with the aim of understanding them – is what Bacon puts hand to *in hoc opere*, where the purpose is «de omnibus colligere scientiis naturalibus quidquid necessarium erit ad noticiam rerum naturalium»<sup>62</sup>. An «introductory compendium» will be obtained, autonomous and self-consistent but connected to other texts, commanding a network of specialized references, critically essayed and compiled; it is part and parcel of an encyclopedic overall plan, so that finally «per vias has magnificas possint magnifice sciri naturalia et non per vias vulgatas, que actenus sunt in usu»<sup>63</sup>.

The complexity of this endeavour emerges dramatically from the fact that the terms *natura* and *naturalis* – while constituting

59. See CN, 12–13.

60. CN, 12.

61. CN, 13.

62. *Ibid.*

63. *Ibid.*

the object of the whole text – can not find a precise definition in the *distinctio De natura et modis eius*, where we would expect to find it; or rather, it finds several definitions, not just one. In the three chapters that make up this *distinctio* several possible meanings of the term are in fact referred to, under the auspices of the *auctoritates* of Aristotle and Boethius. This is not unexpected, considering the cumulative attitude that Bacon often shows, as if he wanted to indicate that a «definition» will only be available as a result of the whole work. The true Baconian conception of nature is perhaps only to be found when he distinguishes between a *nature regitiva universalis* and a *nature regitiva particularis*<sup>64</sup>, yet without specifying the meaning of the term «nature», save for its denoting the corporeal world in all its aspects.

These preliminary, orientative considerations by Bacon, especially those relating to Aristotle's natural philosophy, allow us – we believe – to better understand and clarify some aspects that impress the reader of CN. We refer, first of all, to the constant, continuous and dense dialogue with the Aristotelian texts, very well mastered by Bacon and discussed with competent ease and relevant quotations, yet often leading to unexpected intention by means of garbled interpretation. Evidently Bacon is among those few who – in the previous thirty years – approached the Aristotelian naturalistic texts and their commentators with really intense study, lessons and commitment, so that he can browse them with sure expertise. Aristotle's doctrines do not fully correspond – as we have seen – to the ideal of natural philosophy that Bacon had in mind, although this did not prevent him from taking advantage of a great amount of data, arguments and theories whose weight and value he acknowledges.

Due to these considerations, we are now better able to grasp the nuances that characterize the frequent references that Bacon makes throughout the text to the relationship between the natural philosopher and the metaphysician. In some cases, he points out the real diversity of disciplinary views: investigation into the deep causes of refraction pertains to the metaphysician, while other researchers may be momentarily content with the certainty

64. See CN, 21, 92-96.

of experience<sup>65</sup>. It is appropriate that the metaphysical and the naturalist use different meanings of terms and concepts as matter, form, etc., and we must be attentive to their different uses, in order to avoid misleading interpretations<sup>66</sup>. In particular, many aspects of the *multiplicatio specierum* pertain more to the metaphysician («magis ad methaphisicum pertinent»), especially when it comes to the production of *species* by the spiritual substances, souls or angels<sup>67</sup>. Moreover, the proper level on which the natural philosopher moves can be ascertained: as regards matter, the natural philosopher considers *materiam sensibilem*; while in turn the metaphysician, as far as form is concerned, does not lower his consideration to body, «set solum stat in substantia spirituali»; considerations about spiritual substances, in fact, «non pertinent ad naturalem philosophum sed soli metaphisico reservantur»<sup>68</sup>. In short, natural philosophy can not *ascend* to treat ideas and mathematical entities and should be limited *ad naturalia* staying within its own compass, «quia nulla sciencia excedit suos limites»<sup>69</sup>. These details do not seem to emphasize or prescribe a traditional relationship of subalternation, that Bacon, however, knows and uses when it comes to reporting, especially in the *De celestibus*, functional links between mathematics and natural philosophy<sup>70</sup>. Here, instead, he is indicating an appropriate distinction of approaches that sometimes also need to be coordinated. Aristotle had distinguished the plans of the metaphysical and the naturalist; Bacon surely does the same, but he does not refrain from integrating their tasks when it comes to structuring the basis of his natural research, i.e., when he is attempting to establish his natural philosophy on proper principles, the *communia naturalium*. Not by chance, after all, he mentions his own fundamental text *De multiplicacione specierum* as a metaphysical treatise<sup>71</sup>. Moreover, at the beginning of *Communia Mathematica* (the model text for *Commu-*

65. See CN, 32: «[...] sufficit nunc quod per experientiam certissimam istud mirabile sciamus, et in sequentibus alie experientie adjunguntur, et causarum inquisicio ad metaphisicum noscitur pertinere».

66. See CN, 15, 61.

67. See CN, 42-45.

68. CN, 45.

69. CN, 77.

70. See CN, 316-17, 336.

71. CN, 38: «In tractatu meo *De Speciebus methaphisico*». Cf. D. C. Lindberg, *Roger Bacon's Philosophy of Nature*, Oxford 1933, *Introduction*, XXIX; Lindberg, however, assumes that the text is only about natural philosophy.

*nia Naturalium*) Bacon recognizes the distinction between metaphysics and mathematics, and will respect it; and yet he says that in some cases, though rarely, he will put forth some metaphysical arguments («afferam probationes aliquas metaphisicas»). As a consequence, he will sometimes assume a composite and two-faceted attitude, «quasi assumam officium methaphisici [...] secundum quod res postulat declaranda»<sup>72</sup>. In conclusion, the author invites us to recognize that while it is true that no science can overcome its limits, there shall be «aliqua sciencia communis ad naturalia et mathematicalia et ad omnia, et hec est metaphisica»<sup>73</sup>.

It should be borne in mind that Bacon reported about the limited use he could make of Aristotle's positions on *communia* for his own natural philosophy, since the common natural principles had been treated by Aristotle *imperfecte* and metaphysically with scarce regard to the aim of natural research. One can not escape the conclusion that Bacon, in developing such *naturalia* issues in turn, behaves as a naturalist *and* a metaphysician. Indeed, he wants to identify the founding *medulla* of natural beings (*naturalia*), and intends to consider those principles not in themselves but as related to the sensible reality, which pertains to the natural philosopher. This is the proper task of a natural philosopher, whose goals and methods are other than those of the metaphysician. So the natural philosopher has a specific competence, accompanied, however, by the consciousness that, at least on some occasions, he has to master both approaches and their respective purposes: he has to perform a foundational attitude and yet maintain determined specificity. Therefore he needs to be able to play both roles while recognizing them as different.

This innovative approach is the ground on which it is possible to reuse different materials in different contexts, due to «Bacon's inveterate habit of using his material two or three times over», as remarked by Robert Steele and echoed by David Lindberg<sup>74</sup>. With specific regard to CN, the two tables presented above can

72. CMath, 2.

73. CN, 76.

74. See Steele, *Preface*, in *Metaphysica Fratris Rogeri Baconi (...). De vicis contractis in studio theologiae*, V; Lindberg, *Introduction*, in *Roger Bacon's Philosophy of Nature*, XXVII.

serve as a map of the network of cross-references, both to other Baconian works and to the same CN. This feature of the book confirms its workshop character, open to new acquisitions and arrangements, but also full of references to past achievements. This is the main quality of this work, around which it would be worth deepening the discussion, especially with regard to a number of issues not dealt with by us here: the analysis of the section on *species* as agents, compared with *De multiplicatione specierum* and the *Perspectiva* of *Opus Majus*; form, motion and location; generation; separate substances.

In the laboratory, research goes on.

All the seminar members remember with affection and high esteem Romana Martorelli, who was with us to the end and contributed to the success of our common endeavour with both her scientific contribution and her generous humanity.

