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# LOCKE ON SCIENTIFIC METHODOLOGY

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### 1 Introduction

Many have written about Locke's account of scientific methodology, without agreeing on what it comes down to. The controversy has revolved around Locke's attitude toward hypotheses, so much so that it is sometimes portrayed simply as an opposition between 'Pro-Hypotheses' and 'Anti-Hypotheses' interpreters (Priselac 2017: 176). One side holds that the use of hypotheses has a prominent and irreducibly significant place in Locke's works (Laudan 1967; Soles 1985; Farr 1987; Farr 1987; Priselac 2017: 176–183). The other side contends that Locke grants hypotheses no more than the subservient role of 'aid[ing] the overarching project of natural history' (Anstey 2011: 89; see Yost 1951; Yolton 1970: 62–63). Alternatively, some have sought a 'middle ground' between these two camps: 'Locke was quite skeptical about the prospects for the useful employment of hypotheses in natural philosophy but . . . he did not universally condemn their use; Locke thought that some well-made hypotheses could be helpful' (Connolly 2013: 186–187).

My main goal in this chapter is not so much to resolve the preceding controversy as to bring some much-needed conceptual clarity to it. To motivate this approach, let me begin with two observations about the reasoning of those who think that Locke's scientific method is that of natural history. First, to give circumstantial evidence for their interpretation, they stress Locke's connection to Francis Bacon and Robert Boyle. The latter philosophers, they argue, prioritized data collection and natural-history making and this prioritization would become the 'official policy of the Royal Society' (Yolton 1970: 62; see 44–103). Locke must have also preferred the natural-historical method, then, provided he formed his views in an environment where the 'decrying of hypotheses and of speculative theories had been a defining feature of the experimental philosophy as promoted by members of the early Royal Society' (Anstey 2011: 89). Second, to find direct textual evidence for this methodological leaning, we are asked to consult 'Locke's opinions on the proper method of research in the science he knew best, namely, medicine.' That is, whatever remarks he makes in favor of the natural-historical method in *medicine* are to be read as his 'principal *explicit* utterances on the question of the proper method of research in the empirical sciences [in general]' (Yost 1951: 129–130; see Romanell 1983; Sanchez-Gonzalez 1990).

There are two basic problems in this line of reasoning. The first is conceptual ambiguity, which especially affects the term ‘speculative,’ a term that Locke occasionally uses to characterize hypotheses. Most commentators seem to assume that it refers to what is *merely conjectural*. As we shall see, however, in Locke’s time it more commonly and more importantly meant what is *theoretical* (as opposed to what is practical), particularly as it involves causal explications of phenomena. Second, from Locke’s standpoint, the relation between medicine and natural philosophy was still unsettled, so much so that we should not simply assume that a general scientific methodology can be read off what he has to say about medicine in particular.

Since a great deal in the controversy over Locke’s scientific methodology hinges on mere assumptions about what he meant by such key terms as ‘speculative’ and about how he – and his predecessors as well – viewed the relation between medicine and natural philosophy, I shall devote the bulk of this chapter to challenging those assumptions. In so doing, I take Locke’s indebtedness to Bacon and Boyle, along with the exegetical significance of that relation, as a given. Accordingly, it is crucial to start with a well-founded account of where the latter philosophers stood on the relevant issues. More specifically, I shall begin, in section 2, with an analysis of Bacon’s taxonomy of sciences. In this taxonomy, medicine and physics belong to *separate* branches of ‘philosophy.’ The latter concept, in turn, is specifically tied to human reason and, as such, is differentiated from ‘history,’ which pertains to memory. To problematize the relation between medicine and physics (or natural philosophy), I shall then consider Boyle’s development of the Baconian view and contrast it with the Cartesian one, according to which medicine is *subordinate* to physics.

Only against this backdrop will we be in the position to give a just assessment of Locke’s myriad remarks about the use of hypotheses in physics or natural philosophy on the one hand (section 3) and in medicine on the other (section 4). I shall foreground three basic observations. First, for Locke, no single scientific method applies equally to medicine and physics. We should not expect his methodological views about the former to be generalizable to the latter.

Second, physics, as a *speculative* philosophy that falls in the jurisdiction of human *understanding*, seeks causal explications of manifest phenomena. To this end, it requires more than data collection and natural-history making. In fact, speculative/theoretical hypotheses were already an integral part of the experimental-philosophical program envisioned by Boyle (as I will have shown in section 2), for which Locke would seek mainly to provide further philosophical underpinnings.

Third, while all hypotheses share the epistemic mark of being probable conjectures, Locke would sort them into different kinds in terms of what they are meant to accomplish. He would, for instance, separate speculative and what I call ‘heuristic’ hypotheses, the latter being more suitable to the medical *practices* of curing diseases. Attending to this kind of distinction will allow us both to appreciate the complexities of Locke’s attitude toward hypotheses and to uncover what might be unique about his stance, such as his attention to practical stakes (e.g. life and death).

## 2 Locke on the relation between medicine and physics: a historical perspective

In the final chapter of *An Essay Concerning Human Understanding*, ‘Of the Division of the Sciences,’ Locke separates ‘[a]ll that can fall within the compass of Humane Understanding’ into three branches: physics or natural philosophy; practical science (mainly ethics); semiotics or doctrine of signs. Physics is the ‘Knowledge of Things, as they are in their own proper Beings, their Constitutions, Properties, and Operations.’ It is a ‘speculative’ science aimed at the discovery

and knowledge of truth, in contrast to practical philosophy, which seeks ‘Right, and a Conduct suitable to it’ (4.21.1–5).

There is no obvious way to fit medicine into this division. We only know that, on Locke’s final account of medicine, it should be solely concerned with ‘the curing of diseases’ and ‘the health of mankind’ (*Works IX*: 426). As such, it differs from physics qua speculative science. What else would Locke say to be more specific about their relation, though? In lieu of an explicit answer on his part, I shall approach the question indirectly, by foregrounding a relevant historical controversy. Roughly put, Locke would be confronted with two basic alternatives: either medicine occupies an entirely separate place from physics in the taxonomy of sciences (à la Bacon and Boyle), or it fundamentally depends on physics as, say, a source of its theoretical principles (according to Descartes). I shall examine each option with a view to uncovering its methodological implications, especially regarding the role of hypotheses. Along the way, I shall also draw attention to what the philosophers in question meant by such key terms as ‘history,’ ‘philosophy,’ and ‘speculative.’

My analysis of the pre-Lockean views will be quite detailed, so that it is weighty enough to counter the narrative constructed by those who have taken Bacon and Boyle to prioritize natural history and then projected this prioritization onto Locke. I ask the reader to follow through my analysis with patience, as it contains the necessary conceptual and philosophical apparatus for making sense of Locke’s position, to be outlined at the end of this section.

## **2.1 Medicine and speculative physics in the Baconian division of philosophy**

In *The Advancement of Learning* (first published in 1605), Bacon divides all learning into history (natural or civil), poetry, and philosophy, which pertain to our faculties of memory, imagination, and reason respectively. He then divides philosophy roughly as follows (Figure 30.1).

Four points that Bacon makes about this taxonomy are worth noting, all of which will help to illuminate the key terms involved in the debate over Locke’s scientific methodology. First, the mechanics included here is ‘philosophical,’ as it presupposes some knowledge of ‘physical causes’ of things. It contrasts with ‘the bare effective or empirical mechanics,’ which ‘has no dependence on physics, and belongs to natural history’ (Bacon 1901: 168). This contrast exemplifies Bacon’s general distinction between what is *philosophical* and what is *historical*, which correspond to the human faculties of reason and memory, respectively.

Second, ‘speculative’ as a technical term signifies what pertains to the search for *causes* of things. What is ‘speculative’ or ‘theoretical’ differs from what is ‘practical,’ then, as ‘the search after causes’ versus ‘the production of effects’ (ibid. 145).

Third, physics and metaphysics are independent branches of natural philosophy. They investigate different kinds of causes: efficient causes and matter for physics, final causes and form for metaphysics. This arrangement directly opposes the Aristotelian treatment of metaphysics as *philosophia prima* (ibid. 145–47). A true first philosophy, Bacon states, would be ‘some general science’ that contains ‘axioms . . . common to a number of [sciences]’ and shows ‘nature to be one and the same’ (ibid. 138, 140).

Finally, medicine is entirely distinct from physics in the taxonomy.

It is presumably with this Baconian taxonomy in mind that Boyle recommends different methods for doing physics and practicing medicine. He talks about the former extensively in *The Origin of Forms and Qualities* (1666–7) among other works. This treatise, according to its publisher, puts forward ‘a New *Hypothesis* [the Corpuscular Hypothesis] . . . made out by daily Observations, familiar Proofs and Experiments,’ whereby ‘the noble *Project* of the famous

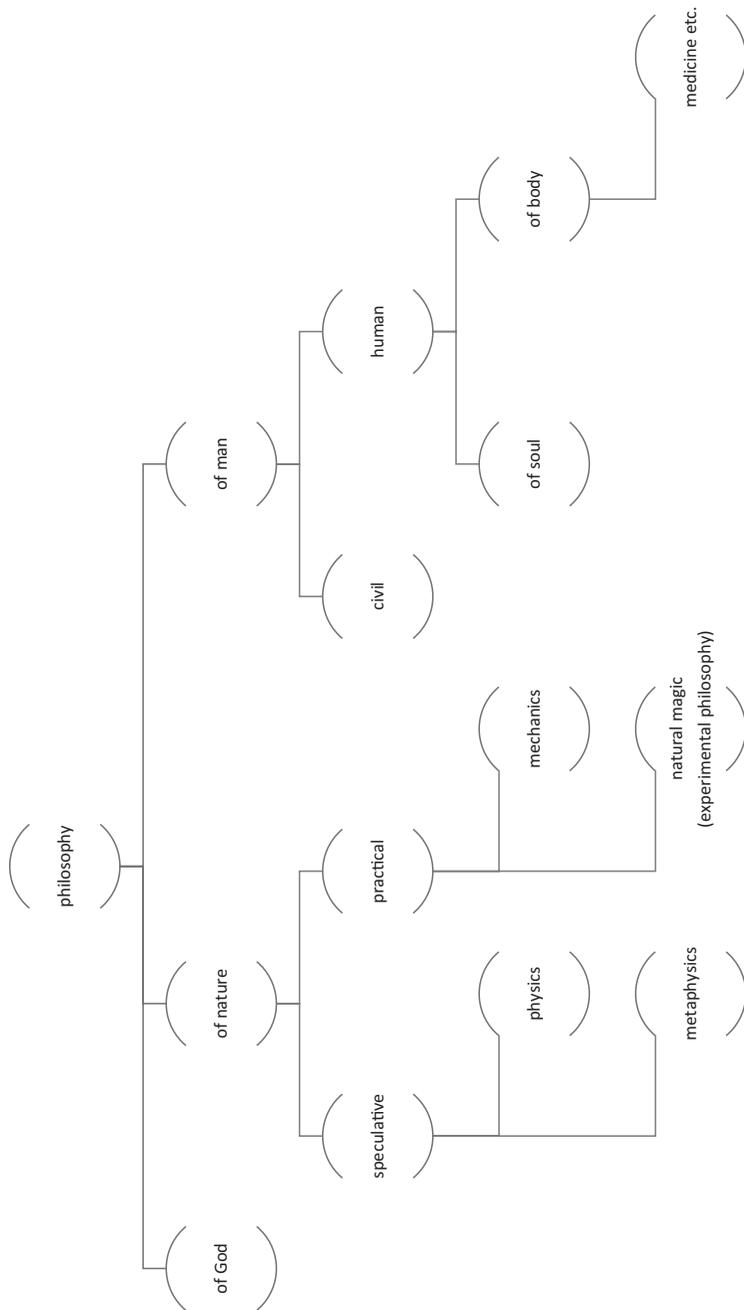


Figure 30.1 Bacon's division of philosophy

VERULAM [Bacon] . . . [may] receive its full and perfect Accomplishment,' namely 'a real, useful, and experimental *Physiology* [i.e. physics] established and bottomed upon easie, true, and generally received *Principles*' (Boyle, *Works* 5: 283–284). In Boyle's own words, he seeks a methodically established 'new philosophy' of nature. He proceeds in two steps: the theoretical or speculative part includes, among other things, a 'considerable number of Notions and Arguments, towards the compleating and confirming of the propos'd [Corpuscular] *Hypothesis*'; the experimental, historical, or practical part then supplies 'particular Experiments' to prove the plausibility of the proposed hypothesis (ibid. 295–296; see 305–335, 379–442).

Boyle thereby fleshes out the Baconian vision of a first philosophy that shows nature to be one and the same: all bodies share the same 'common Matter,' namely 'a Substance extended and impenetrable.' Motion is its chief affection. Thanks to motion, matter can be indefinitely divided into smaller parts, including insensible *minima Naturalia*. These minute corpuscles have determinate sizes and shapes. Each has 'Bulk, Figure, and either *Motion* or *Rest*' as its three primary affections, and has a certain position and order in relation to other particles. All observable phenomena of natural bodies can, in principle, be explained ultimately in terms of the motion of a consortium of such particles (ibid. 333–335).

This theory of nature, qua 'hypothesis,' is a *supposition* by which to *explicate* natural phenomena, making them understandable as the manifest *effects* of certain physical *causes* (Boyle, *Works* 13: 272). It competes with such other hypotheses as the Aristotelian theory of substantial forms and the modern chemists' *tria prima*. If all of them are logically possible and none can be demonstrated as true or false a priori, we need a methodic way to decide, a posteriori, which is the *most plausible* way to decipher nature as 'God's Epistle written to Mankind.' The Corpuscular Hypothesis can be established as the best cipher, Boyle submits, only on account of its exceptional ability to explicate all sorts of natural phenomena in a way that is clear, coherent, and congruent with known observations and laws of nature. That is,

if the Mechanical [Corpuscular] Philosophy go on to explicate things Corporeal at the rate it has of late years proceeded at, . . . unprejudic'd persons will think it sufficiently recommended by its consistency with it self, and its applicableness to so many Phenomena of nature.

(Boyle, *Works* 8: 115)

The *if*-clause just quoted captures the experimental aspect of Boyle's program. The Corpuscular Hypothesis (capitalized to indicate its level of abstraction), as a conjecture about the underlying material structure and causal mechanism of nature *in general*, cannot be directly tested. Only its more determinate specifications can: within the overarching framework of the Corpuscular Hypothesis, one first has to formulate *specific* 'Physical Hypotheses' to explain particular kinds of natural phenomena, e.g. those 'in *Hydrostaticks*, the practical part of *Opticks*, *Gunnery*, &c.' (ibid. 114–115). Each hypothesis is still speculative in the Baconian sense, whereby the 'inquisitive naturalists' seek causal explanations of the target phenomena by examining 'what changes are made in the *Patient*, to bring it to exhibit the Phenomena that are propos'd, and by what means, and after what manner, those changes are effected' (ibid. 109). The hypothesis must satisfy a list of preliminary conditions, such as consistency with other known natural phenomena and the ability to generate empirically verifiable predictions. One can then run experiments to test it (Boyle, *Works* 5: 395–442).

Note that medicine does not belong in Boyle's experimental natural philosophy, although he holds that the latter can be 'serviceable' to medical practices by 'the detection of the Medical Virtues of things' (Boyle, *Works* 6: 431). He argues for this view in *Of the Reconcilableness*

of *Specifick Medicines to the Corpuscular Philosophy* (1685), with a palpable recognition that the relation between medicine and physics was a matter of controversy at the time. Responding to a certain physician's contention that the Corpuscular Philosophy is useless to the curing practices of 'specifick medicines,' Boyle argues that the 'experienced vertues' of specific medicines can be reconciled to the principles of corpuscular physics or 'at least do not subvert them, if these Effects and Operations be not clearly explicable by them.'<sup>1</sup> In this way, he speaks 'less like a Physician than a Naturalist' engaged in 'a Speculative discourse.' If the naturalist's physics – a science that 'search[es] into the nature and *Phaenomina* of things corporeal indefinitely' – and the physician's 'Medicinal Art' may be 'conversant about the same subject,' they will do so 'in differing ways, and with differing scopes.' While the naturalist investigates the 'divers hurtful or advantageous accidents and changes of the humane Body' speculatively, as phenomena produced by certain 'Natural causes in the Body of an Animal,' the physician treats them as 'Symptoms of Diseases, or Effects of Medicines.' They do so with *different aims*, 'the former directing his Speculations to the discovery of truth, and the other his Theory to the recovery of health' (Boyle, *Works* 10: 353).

Boyle is nevertheless hopeful that the naturalist's speculative explications of bodily phenomena may have useful 'applications' to medical practices. They may, in particular, suggest to the physicians promising remedies that

have either remain'd unthought of [by physicians from various schools] . . . or if propos'd by others, have been rejected or slighted, barely upon this supposition, that no rational account can be given of their way of working, or how they should do good.

(*ibid.* 354)

By showing that it is 'at least possible' for specific medicines to 'perform their operations by ways, which . . . are intelligible, and reconcileable to the clear Principles of the Mechanical [Corpuscular] Philosophy,' Boyle seeks to 'inlarge the minds of many Physicians, and invite them to make use of several Remedies, of which they did not think, or against which they were prejudic'd' (*ibid.* 354). In this way, he takes himself to be counteracting a *dogmatic* refusal by some physicians even to acknowledge the possibility that speculative theories of physics may benefit the curing practices of medicine.

## 2.2 *Descartes on the relation between medicine and physics*

Contrary to Boyle's relatively modest view of how physics may be useful to medicine, Descartes holds that medicine *depends* on physics as its theoretical foundation. This view is reflected in his famous tree of philosophy (Figure 30.2).

Metaphysics makes the 'roots' of this tree, as it contains 'the principles of knowledge.' Physics is the trunk, 'where, after discovering the true principles of material things, we examine the general composition of the entire universe and then, in particular, the nature of this earth and all the bodies which are most commonly found upon it.' The three particular sciences are 'branches' growing from this trunk (Descartes 1985: 186). If mechanics is 'a division or special case of physics, and all the explanations belonging to the former also belong to the latter,' the same may be said about medicine. Thus, Descartes counts both mechanics and medicine among sciences that 'can be fully developed with the help of physics' (*ibid.* 288–289).

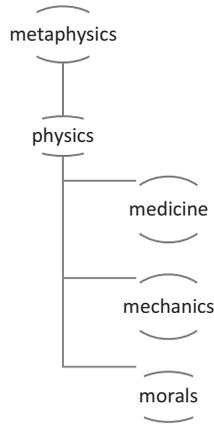


Figure 30.2 Descartes's tree of philosophy

Another Cartesian way to consider the place of medicine is in terms of a distinction between the speculative and practical sides of physics: while physics qua speculative seeks ‘causes . . . by way of their effects,’ its practical side seeks ‘effects . . . by way of causes’ to yield ‘the harvest of true physics,’ namely benefits to human life (ibid. 77). Descartes envisions a practically oriented philosophy, through which we could know distinctly the powers and actions of all bodies, ‘the maintenance of health’ being the most important consequence of such knowledge: ‘we might free ourselves from innumerable diseases . . . if we had sufficient knowledge of their causes and of all the remedies that nature has provided’ (ibid. 142–143). Descartes is indeed personally committed to seeking ‘some knowledge of nature from which we may derive rules in medicine which are more reliable than those we have had up till now’ (ibid. 151). After all, ‘it is so important to know the true cause of the heart’s movement,’ for instance, that ‘without such knowledge it is impossible to know anything which relates to the theory of medicine’ (ibid. 319).

### 2.3 Locke’s view: a primer

Recall that Locke included physics in his division of sciences as a speculative philosophy aimed at truth, while leaving no obvious place for medicine. Now, Bacon, Boyle, and Descartes all shared Locke’s view that the immediate end of medicine is bodily health and, in this way, it differs from physics qua speculative, with the latter seeking causal explanations of bodily phenomena. But they presented Locke with two fundamentally different pictures of the relation between medicine and physics. On the Cartesian account, medicine is *subordinate* to physics, in that physical knowledge about human bodies in general is both necessary and, if complete and coupled with adequate empirical observations about individual cases, sufficient for medicine (Descartes 1985: 143–144). On the Baconian account as Boyle developed it, medicine does not fall under physics at all, not even under the practical side thereof, which serves primarily to test speculative hypotheses about nature. Physics may benefit medicine by offering causal explications of various phenomena of human bodies that *suggest the theoretical possibility* of certain remedies, for example, which would not have occurred to the physicians otherwise. Contrary to what Descartes thought, however, medicine does not on that account depend on physics as

its theoretical underpinning. Locke, as we shall see in section 4, leans toward the Baconian side, although he will be reluctant to go all the way.

Meanwhile, physics has its own proper method independently of how one thinks medicine should be practiced. Here, Locke is again confronted with two radically different approaches. Descartes's tree of philosophy indicates a top-down route from metaphysics to physics, which promises to deliver *a priori* certain, universal truths about nature. By contrast, Boyle's division of physics into the speculative/theoretical and historical/practical branches gives us an experimental program, whereby various physical hypotheses are to be tested, *a posteriori*, for their probability. Locke's methodological remarks about natural philosophy are best explained as a rejection of the Cartesian view in favor of Boyle's account. Or so I shall argue next.

### 3 Locke on natural philosophy and its method

In Locke's view, natural philosophy or physics is 'not capable of being made a Science' (*Essay*, 4.7.10). It cannot be made a 'speculative science,' to be more specific, because nature operates 'by ways, too far surpassing our faculties to discover, capacities to conceive, for us ever to be able to reduce them into a science' (*Works IX*: 182). That is, we can have no strictly 'scientific' (i.e. demonstratively certain) or 'philosophical' knowledge of bodies (*Essay*, 4.3.26). We may still pursue natural philosophy, albeit 'not as a science that, can be methodized into a system, and treated of, upon principles of knowledge; but as an enlargement of our minds towards a truer and fuller comprehension of the intellectual world' (*Works IX*: 183). Thus, while denying the possibility of a strict science of natural philosophy for the human understanding, Locke does not intend thereby 'to dis-esteem, or *dissuade the Study of Nature*.' Rather, this study can, 'if rightly directed,' greatly benefit us as well as give us 'occasion to admire, revere, and glorify' God as the author of nature's works (*Essay*, 4.12.12).

So, Locke rejects one *way of doing* natural philosophy in favor of another. Descartes represents the way being rejected. To him, philosophical knowledge comes down to 'perfect knowledge of all things that mankind is capable of knowing, both for the conduct of life [morals] and for the preservation of health [medicine] and the discovery of all manner of skills [mechanics]; *perfect* knowledge being knowledge 'deduced from first causes' or principles (Descartes 1985: 179). Descartes's aforementioned tree of philosophy encapsulates his effort to methodize physics into a system of perfect knowledge: the most general principles of physics are demonstrated as certain by being derived, *a priori*, from the principles of knowledge established in metaphysics; those physical principles then serve as the theoretical foundations for particular sciences like medicine.

Boyle represents the experimental way of doing physics that Locke favours, which aims at an indefinitely *truer* and *fuller* – not *the* true or complete – understanding of nature. It is still 'philosophical,' but only in the following Baconian sense: it is an endeavour by human *understanding* – as distinct from memory and imagination – to *explicate* natural phenomena as effects of certain natural causes, in which sense it is also speculative or theoretical. It is in these terms that Locke, having denied the possibility of physics as a strict philosophical science (in the Cartesian sense), reasserts its legitimacy as a 'speculative' science of things regarding their constitutions, operations, etc. that 'fall within the compass of Humane Understanding' (*Essay*, 4.21.1–2).

Locke accepts two basic tenets of the experimental approach. First, there is 'a Law' by which 'Causes work steadily, and Effects [viz. observable phenomena] constantly flow from them.' We *cannot know what* that law is in itself with certainty, though. Rather, the '*Connexions* and *Dependancies* [between causes and effects] being not discoverable in our *Ideas*, we can have but an experimental Knowledge of them' (*Essay*, 4.3.29). Second, if the 'corpuscularian Hypothesis'

is the best supposition that we can conceive as an ‘intelligible Explication of the Qualities of Bodies’ in general, we have yet to see how far it may extend our knowledge of particular bodies. We ‘must depend on’ experience in this regard (4.3.16). More specifically,

- 1 we may suppose that the ‘insensible Corpuscles [are] the active parts of Matter, and the great Instruments of Nature,’ on which depend all natural operations of bodies.
- 2 For any two bodies, had we ‘precise distinct Ideas’ of the figure, texture, motion, etc. of their constituent corpuscles, we would have a priori knowledge of their operations on each other, with as much certainty as we do in geometry. This route is unavailable to us, though, since we lack those ideas.
- 3 As for empirical ‘Trials,’ if a few have assured us about some ways in which the corpuscles operate, ‘whether they will succeed again another time, we cannot be certain.’
- 4 Therefore, we cannot have ‘certain Knowledge of universal Truths concerning natural Bodies: and our Reason carries us herein very little beyond particular matter of Fact’ (*Essay*, 4.3.25; see 4.3.26 & 29).

Accordingly, the proper aim of natural philosophy is not *certain and universal knowledge* of bodies, which would assert *necessary connections* between manifest effects and their causes, but rather *probably true opinions* in the causal explications of natural phenomena.

This account of natural philosophy undoubtedly has methodological implications, since we must ‘*adapt our methods of Enquiry to . . . the Truth we search after*’ (*Essay*, 4.12.7). It is far from clear, however, what method Locke would recommend to the natural philosopher. Unsurprisingly, then, interpreters still disagree with one another about the nature of Locke’s scientific methodology, as I mentioned at the outset of this chapter. In lieu of a thorough defence of ascribing to Locke a hypothetical method for doing physics (while acknowledging the importance of natural history), I shall only make a few remarks in that direction.

First, if Locke is expressly weary about the use of hypotheses in the *Essay*, this attitude may have to do with his self-appointed role as ‘an Under-Labourer [to master-builders like Boyle] in clearing Ground a little, and removing some of the Rubbish, that lies in the way to Knowledge’ and to ‘Philosophy, which is nothing but the true Knowledge of Things’ (*Essay*, Epistle to the Reader). When he notes ‘how little general Maxims, precarious Principles, and Hypotheses *laid down at Pleasure*, have promoted true Knowledge,’ his point is that ‘the *setting out* at that end,’ a dominant course of enquiry ‘for many Ages,’ has done little to advance mankind’s ‘Progress towards the Knowledge of natural Philosophy’ (*Essay*, 4.12.12, my emphasis). This is a caveated warning against *starting* one’s investigation of nature with *arbitrarily generated* hypotheses. A true naturalist, by contrast, ‘ought to build his Hypothesis on matter of fact, and make it out by sensible experience, and not presume on matter of fact, because of his Hypothesis’ (2.1.9). By this insistence on the *proper ordering* of facts and hypotheses, Locke’s point is definitely ‘Not that we may not, to explain any *Phaenomena* of Nature, make use of any probable *Hypothesis* whatsoever’ (4.12.13).

Second, putting facts ahead of hypotheses as the starting point of one’s inquiry does not mean that hypotheses can at best play a subservient role in physics by, say, merely facilitating the making of natural histories. To a Baconian natural philosopher, collecting and organizing facts is not an end in itself. (Recall Bacon’s distinction between natural *history* and natural *philosophy*.) When Locke says that we can advance our understanding of bodies ‘only by Experience and History,’ the understanding he has in mind – in the form of ‘Judgment and Opinion, not Knowledge and Certainty’ – is *directed* at ‘the Nature of Bodies, and . . . their yet unknown

Properties.’ Greater familiarity with ‘rational and regular Experiments’ is valuable to the naturalists because it allows them to make ‘righter’ judgments on such matters (*Essay*, 4.12.10). That is, if they ‘must be content to glean . . . from particular Experiments,’ including ‘Experience, Observation, and natural History,’ they do so with the *goal* to gain some true ‘insight into corporeal Substances’ (4.12.12). This orientation reflects the ‘speculative’ and ‘philosophical’ character of physics in the Baconian sense explained earlier: a natural philosopher *explicates* phenomena as effects of some causes and, if such explications must draw from natural history among other empirical sources, they also go beyond the latter, which is only an organized collection of facts and in itself gives us no philosophical *understanding* of the phenomena under investigation.

Third, the hypotheses that Locke grants in natural philosophy are meant to *explain* phenomena in causal terms. They are suppositions that speculative understanding makes while seeking to ‘penetrate into the Causes of Things.’ They can greatly assist this intellectual endeavour ‘if they are well made’ – if, above all, we take up a hypothesis ‘not . . . too hastily,’ but only after having ‘very well examined Particulars, and made several Experiments, in that thing which we would explain by our Hypothesis, and see whether it will agree to them all.’ Meanwhile, we should keep in mind that a physical hypothesis, no matter how much probability we have ascribed to it on experimental grounds, remains to be a ‘doubtful conjecture’ as opposed to ‘unquestionable Truth’ (*Essay*, 4.12.13).

Fourth, Locke is no Boyle when it comes to providing a detailed account of the specific rules for methodically formulating and testing physical hypotheses.<sup>2</sup> Boyle, as we saw in section 2, envisioned and personally carried out a program in which the naturalists would design particular experiments to test explanatory hypotheses about different kinds of phenomena. That program is pivotal to Corpuscular physics, since the plausibility of the overarching Corpuscular Hypothesis hinges on its success. If Locke suggests that it is not his ‘business’ to be directly involved in such a program (*Essay*, 4.3.16), he does not thereby disapprove it. As the aforementioned under-labourer passage made it clear, Locke has a different agenda in mind than Boyle did. It complements Boyle’s by a closer examination of the relevant *foundational* issues, such as determining the boundaries and end of physics by analysing the capacities and limitations of human understanding.<sup>3</sup>

Finally, given the Baconian tradition of separating medicine and physics, Locke’s occasional objections to the use of hypotheses in medicine should not be used as evidence that he rejects the hypothetical method in natural sciences broadly construed. In fact, as I argue next, such objections do not even show that he disallows all forms of hypotheses in medicine.

#### 4 Locke on medicine and its method

In a letter to Dr. Thomas Molyneux in 1692/3, Locke compares two ‘way[s] of physic [aka. medicine].’ One is the ‘romance way’ that he, as well as Molyneux, finds objectionable:

beginning at the wrong end [with conjured-up theories passed for unquestionable truths], . . . men lay the foundation in their own fancies, and then endeavour to suit the phenomena of diseases, and the cure of them, to those fancies.

The alternative is the ‘better way’ pioneered by Thomas Sydenham.<sup>4</sup> This approach requires the physicians ‘[n]icely to observe the history of diseases in all their changes and circumstances,’ so that they ‘may be convinced of their error by unerring nature and matter of fact, which

leaves less room for the subtlety and dispute of words' (*Works IX*: 464). Locke writes similarly in another letter to Molyneux:

[physicians should] follow [Sydenham's] example, and by the way of accurate practical observation . . . enlarge the history of diseases, and improve the art of physic, and not by speculative hypotheses fill the world with useless, though pleasing visions.  
(*ibid.* 461)

It is tempting to take such remarks as straightforward evidence that Locke rejects the hypothetical method at least in medicine if not in all sciences. In truth, however, his objection to the use of 'speculative hypotheses' in favour of 'practical observation' in medicine is much more nuanced than it seems.

To appreciate the nuance, consider the following.

- 1 Medicine has different branches. I mentioned *specific medicines* while discussing Boyle's view on the relation between medicine and Corpuscular physics in section 2, which provide remedies that are efficacious in curing particular diseases. In addition, medicine has at least two other parts: *physiology*, which studies the natural or normal constitution of the human body and seeks to explain its functions and operations with the help of anatomy and physics; *pathology*, which studies the preternatural constitution of a human body to uncover the nature and causes of diseases.<sup>5</sup>
- 2 There can be different kinds of hypotheses. The ones a naturalist uses to explain phenomena in causal terms may be deemed *speculative* in the Baconian sense. Presumably, physiologists and pathologists use this type of hypotheses to probe into the causes of natural and preternatural bodily phenomena. By contrast, a practicing physician may use *heuristic hypotheses*, which generalize, probabilistically, so-far-observed correlations between various remedies and kinds of diseases to future, similar cases.

Reading Locke's methodological remarks about medicine with these distinctions in mind, we can make two observations. First, his intention is to promote, as Molyneux puts it, 'the only true method for the prosecuting *the curing part of the practice* of physic' (*Works IX*: 466, my emphasis). Second, if Locke saw the futility of using the speculative hypotheses in vogue – we shall see that he had specific ones in mind – to find efficacious remedies for particular diseases, he would not object to the physicians using certain *heuristic hypotheses* in their curing practices.

To elaborate, the speculative hypotheses supposedly popular among some physicians at the time include 'the Galenists four humours, or the chemists sal, sulphur, and mercury, or the late prevailing invention of acid and alcali.' To Locke, these are but 'so many learned empty sounds, with no precise determinate signification.' In fact, no speculative hypothesis about the human body – as a supposition about 'the works of nature . . . in the constitution of health, and the operations of our own bodies' – can have a 'precise determinate signification' if this requires 'certainty . . . of the tools she uses, or the ways she works by' (*ibid.* 464–465).

Hence, Locke contends, 'there is nothing left for a physician to do, but to observe well, and so, *by analogy, argue to like cases*, and thence make to himself rules of practice.' Using this analogical reasoning together with an 'established history of diseases,' the physician may indeed formulate 'distinct hypotheses concerning distinct species of diseases,' but only as 'distinct arts of memory' and 'artificial helps' to the treatment of particular diseases (*ibid.* 464–465, my emphasis). These heuristic hypotheses presuppose an analogy between sensible phenomena, without telling us

anything about the underlying causes of diseases or what makes such and such remedies efficacious for such and such diseases. Basically, if a given remedy R has, after many trials, shown to cure diseases of type D, then a physician may operate with the hypothesis that R will work for similar instances of D. This hypothesis remains to be a probable conjecture, however well founded it may be on past observations. For, as I quoted Locke in section 3, we can never be certain that what has empirically, but not a priori, proven to be the case will happen again in the future.

What about the kind of speculative hypotheses that Boyle had in mind when he entreated physicians in specific medicines at least to acknowledge the *possibility* that certain Corpuscular-physical theories may benefit their practice, by suggesting remedies that would not have occurred to them otherwise? Suppose Locke was right to dismiss the speculative hypotheses popular among the 'learned physicians,' such as Galen's four humours, for having 'done more to hinder the true art of Physic, which is the curing of diseases, than all other things put together' (ibid. 426). He has not thereby ruled out that *better speculative hypotheses*, if methodically introduced within the framework of a carefully designed experimental physics, may help to advance medicine in the way Boyle envisioned. Should Locke dismiss this possibility outright, might he be committing the physicians' dogmatism that Boyle tried to counter?

It is not obvious how Locke would respond. All we know is that he, by his own account, has so much 'zeal for the saving men's lives, and preserving their health,' that he is willing to risk being 'carried . . . too far,' albeit excusably so, as 'one who wishes well to the practice of physic' (ibid. 465). This remark points to an interesting feature of Locke's position: in the field of medicine, judgments about hypotheses should be sensitive to *practical stakes*. To him, the stakes can be so high – a matter of life and death – that the threshold for accepting or even considering a speculative hypothesis must be exceedingly high. Accordingly, with respect to the relation between Corpuscular physics and the curing part of medicine, Locke might have a different message to deliver than Boyle did, being more concerned to *curb enthusiasm* than to counter dogmatism: even if this new physics has proven advantageous in other areas like applied optics, one should be extremely cautious about extending it to medicine, given the unusually high stakes involved here.

## Notes

- 1 See the entry 'specifick medicines' in Harris 1704 (no pagination), an encyclopedic dictionary reflecting the impact of the Royal Society.
- 2 One may nevertheless reconstruct such an account on Locke's behalf. See Soles 1985: 366–368; Farr 1987: 66–69; Connolly 2013: 187–198.
- 3 For different takes on Locke's attitude toward Corpuscularianism, see Halabi 2005 versus Downing 1998.
- 4 On Sydenham's method, see Yost 1950; Bates 1977. On Locke's relation to medicine, see Romanell 1984; Gordon-Roth, 'Locke on Midwifery and Childbirth: A Glimpse of a Sexist Epistemology?' and Walmsley, 'Locke on Physiology and Medicine' in this volume.
- 5 See the entries 'physiology' and 'pathology' in Harris 1704.

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