

The Life Sciences in Early Modern Philosophy

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EDITED BY OHAD NACHTOMY

and

JUSTIN E. H. SMITH

OXFORD
UNIVERSITY PRESS

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Published in the United States of America by
Oxford University Press
198 Madison Avenue, New York, NY 10016

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Library of Congress Cataloging-in-Publication Data
The life sciences in early modern philosophy / edited by Ohad Nachtomy and Justin E. H. Smith.

pages cm
Includes index.

ISBN 978-0-19-998731-3 (hardback : alk. paper)

1. Biology—Philosophy. 2. Life sciences—Philosophy. 3. Evolution (Biology)

I. Nachtomy, Ohad, editor of compilation.

QH331.L538 2013

570.1—dc23

2013010357

1 3 5 7 9 8 6 4 2

Printed in the United States of America
on acid-free paper

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Epigenesis as Spinozism in Diderot's Biological Project

CHARLES T. WOLFE

1. Introduction

Denis Diderot's natural philosophy is deeply and centrally 'biologistic': As it emerges in the mid-18th century, thus right before the appearance of the term 'biology' as a way of designating a unified science of life, his project is motivated by the desire both to understand the laws governing organic beings and to emphasize, more 'philosophically,' the uniqueness of organic beings within the physical world as a whole. In what follows, I examine a little-known aspect of Diderot's articulation of his project: his statement in favour of biological epigenesis within the short but suggestive *Encyclopédie* article "Spinosiste."¹

What possible relation could there be between Spinozism and epigenesis? Between a metaphysics of substance and modes that, even if it is also a major statement of philosophical naturalism, says almost nothing about biological entities, and a fashionable embryological theory of the 17th and 18th centuries?²

¹ Denis Diderot, "Spinosiste," *Encyclopédie*, vol. XV (1765): 474a. On the emergence of biology as such, see Joseph Caron, "'Biology' in the Life Sciences: A Historiographical Contribution," *History of Science* n° 26 (1988): 223–268; Peter McLaughlin, "Naming biology," *Journal of the History of Biology*, vol. 35 (2002): 1–4; and Guido Barsanti, "Lamarck: Taxonomy and Theoretical Biology," *Asclepio*, vol. 52, n° 2 (2000): 119–131.

² Sometimes the *conatus* is presented as a 'vital force,' a 'survival principle' within the organism that leads it to seek to persevere in its existence; or Spinoza is interpreted as an 'organistic' (notably in Hans Jonas's "Spinoza and the Theory of Organism," *Journal of the History of Philosophy*, vol. 3 (1965): 43–57; reprinted in Jonas, *The Phenomenon of Life. Towards a Philosophical Biology* [New York: Harper & Row/Dell, 1966]). But, as François Duchesneau showed, it is a mistake to make such a sharp distinction between Cartesian mechanism and Spinozism: The *conatus* is itself a mechanical relation between the activity of one individual and others (Duchesneau, "Modèle cartésien et modèle spinoziste de l'être vivant," *Cahiers Spinoza* 2 [1978], 273).

A difficulty in many histories of biology, or works focusing on the so-called history and philosophy of biology (such as Grene and Depew's "episodic history"³) is that they flatten out the series of theories, positions, and controversies therein, in a rather linear fashion: preformationism versus epigenesis, Harvey versus Descartes on circulation, Bernard on the *milieu intérieur*, and so on. In contrast, my concern is not so much to stress innate complexity or the nonlinearity of any particular context (whether in the form 'Paracelsus was right!' or the counterfactual 'What if midwives had succeeded in their efforts to be recognized and form a Royal College?'), but to point out—here, with respect to epigenesis in its 'materialist' appropriation—that other factors, interests, and intentions are at work that do not fit well either into a history of discoveries or a catalogue of theoretical background positions implicit in the naturalist's practice. These sorts of factors are both ideological and metaphysical; they are often highlighted, in contrast, in histories organized around ideas such as 'the radical Enlightenment.'⁴ But such histories have very little to say about the integral relation between such radicalism and shifts in the life sciences, for they focus on heterodoxy, politics, and of course philosophical polemics at the expense of naturalistic concerns (an exception being Ann Thomson's work, which seeks to tell a more unified story⁵). To be fair, the existence of a 'vital materialism' has been emphasized in recent scholarship (although the term goes at least as far back as the 1960s, with Jean Wahl and Yvon Belaval⁶). But this still leaves out the clandestine, radical dimension: The fascination with generation, species, or 'vital minima' is neither just the expression of prodromes or rough drafts of a future normalized science (as presented, typically, in works such as *Forerunners of Darwin*⁷), nor a merely ideological construct 'on top of' historical, socio-cultural discourses.

Epigenesis has been many things to many people. Most generically, it is the embryological theory that "organs ... are progressively formed from, or emerge

³ Marjorie Grene and David Depew, *The philosophy of biology: an episodic history* (Cambridge, UK: Cambridge University Press, 2004).

⁴ Jonathan Israel, *Radical Enlightenment. Philosophy and the Making of Modernity, 1650–1750* (Oxford, UK: Oxford University Press, 2001).

⁵ Ann Thomson, *Bodies of Thought: Science, Religion, and the Soul in the Early Enlightenment* (Oxford, UK: Oxford University Press, 2008).

⁶ Hanns Peter Reill, *Vitalizing Nature in the Enlightenment* (Berkeley, CA: University of California Press, 2005). Jean Wahl describes Diderot as a "vitalist materialist" and the Leibnizian philosopher of nature Jean-Baptiste Robinet as a "materialist vitalist" (*Tableau de la philosophie française* [Paris: Gallimard, 1962], 53, 54). Yvon Belaval suggests that Diderot's non-mechanistic materialism, which brings him close to vitalist insights (of the non-supernaturalist variety), should be described as "un vitalo-chimisme ou un chimio-vitalisme"; "Sur le matérialisme de Diderot," in *Europäische Aufklärung. Herbert Dieckmann zum 60. Geburtstag*, eds. H. Friedrich and F. Schalk (Munich, DE: Wilhelm Fink, 1967), 9–21; reprinted in Belaval, *Études sur Diderot* (Paris: PUF, 2003), 367.

⁷ *Forerunners of Darwin, 1745–1859*, eds. Bentley Glass, Owsei Temkin, and W. L. Straus (Baltimore, MD: Johns Hopkins University Press, 1959).

from, an originally undifferentiated, homogenous [material].⁸ Or, that organisms in development increase in complexity as the result of the operation of physical laws on a nexus of simpler resources.⁹ But from Harvey to Maupertuis and Diderot (the story gets complicated by Kant, because he uses epigenesis both as a metaphor for his view of the development of the mind [i.e., that the origin of cognitions cannot be accounted for in either empiricist or innatist terms]¹⁰ and more literally, in a complex *Auseinandersetzung* with embryologists such as Johann Blumenbach, where Kant comes out on the side of the epigenetic theory in biology but worries about hylozoism¹¹), epigenesis does count as a name for a point of intersection between a more *empirical* theory of biological development and a more *speculative* theory of the vital potentiality of matter to self-organize. In that sense, to focus on the case of epigenesis in just about any context in the 17th or 18th centuries is to be confronted with a total breakdown of any convenient distinction between 'experimental' and 'speculative' modes of natural philosophy (of the sort suggested, e.g., in Peter Anstey's recent work¹²). And this is not only true of materialists such as La Mettrie and Diderot; it is also the case in the reflections on generation and reproduction of Charles Bonnet.

⁸ C. U. M. Smith, *The Problem of Life: An Essay in the Origins of Biological Thought* (New York: Wiley, 1976), 264.

⁹ Paul Griffiths and Karola Stotz, "How the mind grows: a developmental perspective on the biology of cognition," *Synthese* 122 (2000), 34.

¹⁰ "Intuitions of the senses (in accordance with sensible form or matter) yield synthetic propositions which are objective. Crusius explains the real principle of reason according to a systematae praeformis (from subjective principiis); Locke according to influxo physico like Aristotle; Plato and Malebranche from intuitu intellectuali; we according to epigenesis from the use of natural laws of reason" (a 'Reflexion' of 1770–1771, n° 4275 in Kant, *Kants gesammelte Schriften*. Hrsg. von der Königlich Preussischen Akademie der Wissenschaften zu Berlin. (Reprint, Berlin: De Gruyter, 1900–), XVII, 492. On epigenesis in Kant, see Wayne Waxman, *Kant's Model of the Mind* (Oxford, UK: Oxford University Press, 1991), 249–267.

¹¹ *Critique of Judgment* §81; *Kants gesammelte Schriften*, V, 424f.; on hylozoism: "We perhaps approach nearer to this inscrutable property if we describe it as an analogue of life, but then we must either endow matter, as mere matter, with a property that contradicts its very being (hylozoism) or associate it with a foreign principle standing in communion with it (a soul)" (*ibid.*, §65; *Kants gesammelte Schriften*, V, 374–375). This can sound 'vitalistic,' which is a danger for a Kantian. Kant cites Maupertuis's molecules "endowed with intelligence" (and desire, aversion, and memory) as a major example of the dangers of hylozoism in *Der einzig mögliche Beweisgrund zu einer Demonstration des Daseins Gottes*, cited in John Zammito, "Kant's early views on epigenesis: The role of Maupertuis," in *The problem of animal generation in early modern philosophy*, ed. J. E. H. Smith (Cambridge, UK: Cambridge University Press, 2006), 343. On the metaphysics of Maupertuis's molecules, see C. T. Wolfe, "Endowed molecules and emergent organization: the Maupertuis-Diderot debate," *Early Science and Medicine* 15 (2010): 38–65.

¹² Peter Anstey, "Experimental Versus Speculative Natural Philosophy," in *The Science of Nature in The Seventeenth Century. Patterns of Change in Early Modern Natural Philosophy*, eds. P. Anstey and J. Schuster (Dordrecht, NL: Springer, 2005).

The question of genre (which of course is much more than a question of genre, but that is a convenient name for it), namely: When are we in the presence of a distinctively ‘biological’ idea, and when are we, in contrast, dealing with a more traditional and/or metaphysically founded ‘matter theory’? is not an easy one, as for instance in the case of Francis Glisson and his metaphysics of life, a theory of innate potentialities or ‘appetites’ in matter.¹³ Epigenesis is thus also a metaphysics of life before Diderot.¹⁴

In the case of William Harvey, who is considered to be the first to use the term ‘epigenesis,’ the blood exists first¹⁵ and pulsates by a sort of fermentation, by ‘an intimate heat or an innate spirit,’ regulated by the *anima*; it is therefore the principal element in the body and the seat of the *anima*, and ‘that in which heat, the primary and immediate instrument of life, is innate.’¹⁶ Walter Pagel called this *vitalism*—rather anachronistic terminology in any case, whether we want to restrict ourselves to ‘actors’ categories’ or, more common-sensically, wish to limit the usage of ‘vitalism’ to contexts in which a special vital property or arrangement is posited; Pagel speaks rather vaguely of “Aristotle’s conception of the vital principle, the *Anima*,”¹⁷ and of Harvey’s vitalism; in both cases, there is no

¹³ See Guido Giglioli, “Anatomist Atheist? The ‘Hylozoistic’ Foundations of Francis Glisson’s Anatomical Research,” in *Religio Medici: Medicine and Religion in Seventeenth-Century England*, eds. Ole Peter Grell and Andrew Cunningham, 115–135 (Aldershot, UK: Scholar Press, 1996); “What Ever Happened to Francis Glisson? Albrecht Haller and the Fate of Eighteenth-Century Irritability,” *Science in Context*, vol. 21 (2008): 465–493; and Antonio Clericuzio, “The Internal Laboratory: the Chemical Reinterpretation of Medical Spirits in England (1650–1680),” in *Alchemy and Chemistry in the 16th and 17th Centuries*, eds. P. Rattansi and A. Clericuzio (Dordrecht, NL: Kluwer, 1994), 59.

¹⁴ One can thus distinguish a Harveyan from a Glissonian ‘tradition,’ in which the latter articulates epigenesis with a metaphysics of life. This is for instance how the mortalist physician William Coward appropriates both Harvey and Glisson; Ann Thomson, “Encore l’âme matérielle,” *La Lettre clandestine*, vol. 14 (2006), 64–65; and *Bodies of Thought: Science, Religion, and the Soul in the Early Enlightenment* (Oxford, UK: Oxford University Press, 2008), 113. Similarly, a metaphysics of vital properties—and the question of whether the physiologist should be concerned with it—appears in the controversy between Robert Whytt and Albrecht von Haller on irritability, in which Diderot appropriates both but sounds more like the former philosophically; François Duchesneau, “Diderot et la physiologie de la sensibilité,” *Dix-huitième siècle* 31 (1999): 195–216; C. T. Wolfe, “Sensibility as vital force or as property of matter in mid-eighteenth-century debates,” in *Sensibilité: The Knowing Body in the Enlightenment*, ed. Henry Martyn Lloyd (Dordrecht, NL: Springer, forthcoming).

¹⁵ “Exercitationes de generatione animalium...” (1651), in *The Works of William Harvey*, trans. Robert Willis (London: Sydenham Society, 1847), 51, 52, 72; discussion in Alan Salter, “William Harvey. A Study in Empiricism,” Ph.D. diss., University of Sydney, Unit for History and Philosophy of Science, 2010; and James G. Lennox, “William Harvey: Enigmatic Aristotelian of the 17th century,” in *Teleology in the Ancient World: Philosophical and Medical Approaches*, ed. Julius Rocca (Cambridge, UK: Cambridge University Press, 2013).

¹⁶ “Exercitationes de generatione animalium...,” 52, in *Works*, 381, and cf. 373, 376, and all of 71, “On Innate Heat.”

¹⁷ Walter Pagel, “William Harvey: Some Neglected Aspects of Medical History,” *Journal of the Warburg and Courtauld Institutes*, vol. 7 (1944), 147.

trace of a claim for the uniqueness of vitality as I previously defined it. Granted, Harvey does hold in the *Generation of Animals* that living things, “as soon as they are endowed with life . . . suffice for their own nourishment and increase, and this in virtue of peculiar inherent forces, innate, implanted from the beginning,”¹⁸ and he speaks frequently in this work of a *vis plastica*.¹⁹ He defines epigenesis as the “addition of the parts that successively arise,” “the superaddition of parts . . . out of the power or potentiality of the preexistent matter (*ex potentia materiae pre-existentis*).”²⁰ But Harvey is not interested in extrapolating from his analysis of the formation of the egg to the metaphysics of life and matter itself, or better, even if he makes partly Aristotelian extensions from the embryological context toward the nature of life itself, his observations and interpretations are not founded on or interrelated with an ontology of life (in contrast to Glisson, but also to Diderot's ‘Spinozist’ construct that I discuss later).

2. Epigenesis as Materialism

How is it that this theory, epigenesis, becomes part and parcel of a vital materialism? For once we get to Maupertuis and Diderot, moving past the impasses reached by preformationist theory, whether ovist or animalist, we find older examples (e.g., ones given already by Harvey) being presented by Maupertuis in the *Vénus physique* in order to assert epigenesis, in the context of a conception of matter as endowed with vital, self-organizing properties: a vital, non-mechanistic materialism. We can call this position *materialism*, in that epigenesis as a theory recognizes in nature the power of self-formation as something material. But it was *vital* in that its proponents (notably Maupertuis) argued that the mechanical principles of physics did not suffice to account for embryo growth and the formation of organisms (“organized bodies”) overall. Reflecting on this process of growth, Maupertuis stated that Newtonian attraction does not sufficiently account for organic phenomena, or even “the simplest chemical operations”²¹; this force alone cannot properly account for the production of *specifically organized bodies*: “A blind, uniform attraction distributed throughout the parts of

¹⁸ Harvey, “De generatione animalium,” Ex. 27, in *Works*, 281.

¹⁹ Harvey, “De generatione animalium,” preface: “De methodo in cognitione generationis adhibenda”; *vis plastica* is translated as “plastic force” or “plastic power” by R. Willis, in his 1843 edition of Harvey's works. Antonine Nicoglou has counted 23 references to ‘*vis plastica*’ in this work. See her thesis in progress, “La plasticité du vivant: une analyse épistémologique,” Université de Paris-1/IHPST.

²⁰ Harvey, “De generatione animalium,” ex. 51, 45, in *Works*, 372, 335.

²¹ Pierre-Louis Moreau de Maupertuis, “Système de la nature. Essai sur la formation des corps organisés and Réponse aux objections de M. Diderot,” in *Œuvres*, 2 vols. (Lyon, FR: Bruyset, 1756), §III, 141.

matter would not explain how these parts arrange themselves to form even the simplest organized body... Why shouldn't they unite at random? (*Pourquoi ne s'unissent-elles pas pêle-mêle?*)²²

Notice that if the theory of epigenesis now explicitly involves the capacity of matter to self-organize, so that complexity emerges out of material processes alone, we are no longer in a strictly biological context. In that sense, again reflecting elements of the story that we will not find in a history of biology (or biological thought), it is important to notice how scandalous the doctrine can be. Diderot's statement of epigenesis as Spinozism is my key case of this scandalousness, but examples can be found quite earlier. For instance, in the early 1700s, Samuel Clarke attacks Anthony Collins for this view, declaring that

It being as impossible that the organized Body of a Chicken should by the power of any Mechanical Motions be formed out of the unorganized Matter of an Egg; as that the Sun Moon and Stars, should by mere Mechanism arise out of a Chaos.²³

Collins had argued that

the Matter of which an Egg consists, doth intirely constitute the young one, and that the Action of Sensation began under a particular Disposition of the Parts by Motion, without the Addition of an Immaterial and Immortal Soul, as the Powers of Vegetation, Gravitation, of producing the Sensation of Heat, Cold, Red, Blue, Yellow, are performed without the Addition of an Immaterial and Immortal Soul.²⁴

As with Harvey and Glisson, it is not easy here to separate the strictly medical or 'biological' content of a theory and the ideologically charged polemical (but also metaphysically speculative) dimension. This is also apparent in Thomas Willis's 'pyrotechnic' account of generation. Willis was only trying to bring together chemistry, anatomy, and physiology to produce an integrated model of brain function and cognitive processes, without materialist intentions, but Henry More attacked him for what he called 'Psychopyrism'²⁵: He felt that "according to

²² Maupertuis, "Système," §XIV, 146–147; and Wolfe, "Endowed molecules and emergent organization."

²³ Clarke, "Letter to Mr. Dodwell [for Anthony Collins]" (Second Defence of the Immateriality and Immortality of the Soul), in *The Works of Samuel Clarke*, 4 vols., 1738 (reprint, New York: Garland, 1978), III, 789.

²⁴ Collins, "A Reply to Mr Clarke's Defence of his Letter to Mr Dodwell," in Clarke, *Works*, III, 768.

²⁵ See his 1682 "A Letter to a Learned Psychopyrist"; John Henry, "Medicine and Pneumatology: Henry More, Richard Baxter, and Francis Glisson's Treatise on the Energetic Nature of Substance," *Medical History*, vol. 31 (1987), 34.

[Willis] the production of a Soul ex Traduce, would end in meer Materialism,²⁶ with the explicitly epigenetic dimension being that “in Generation some matter only is newly modified.”²⁷ And indeed, Willis had spoken of the “Vital Humour in an Egg.”²⁸ In the 18th century, we also find epigenetic concepts either being used with deliberate *philosophical*-materialist overtones, or as experimental/medical concepts, again with some overlap between the two. The physician Abraham Gaultier's semi-clandestine treatise *Parité de la vie et de la mort* (1714) puts forth an emergentist concept of matter, medically inspired and with frequent recourse to epigenetic concepts.²⁹ When the vitalist physician Théophile de Bordeu reflects on the nature of ‘cellular substance,’ he describes a gradual shift from a kind of vital glue, a mucous, nutritive substance, to sheaths of muscular fibre, solely by material superaddition.³⁰

To take stock for a moment, these various examples, from More on Willis and Clarke on Collins to later medical theories and the debate between Maupertuis and Diderot, show (i) that a theory about generation is intertwined with shifts in matter theory, and (ii) that this intertwining has a radical dimension, *sensu* Israel (whose analysis of the Radical Enlightenment,³¹ however, tends to steer clear of the sciences)—for epigenesis is not a metaphysically dangerous theory when Harvey introduces it in 1651. There are other, better-known cases that also combine these elements: The example of the polyp, which fascinated a generation of European scientists, was explicitly taken by Charles Bonnet as an exciting but dangerous challenge to the existence of the soul, or at least of a single, indivisible soul in the body. One could also mention the anatomico-metaphysical study of monsters, or the concern with species and miscegenation in this period.³² But the articulation of epigenesis and materialism shows us something else again at this intersection of radicalism and the new focus on the emergent life sciences. And the sharpest, most distinctive form this takes is in Diderot's Spinozism.

²⁶ Joseph Glanvil and Henry More, *Sadducismus triumphatus: or, A full and plain evidence concerning witches and apparitions* (London: A. Bettesworth and J. Batley, 1726 [1681]), 129.

²⁷ *Ibid.*, 130.

²⁸ Thomas Willis, “Two Discourses Concerning the Soul of Brutes, Which is That of the Vital and Sensitive [Soul] of Man. The first is physiological, shewing the nature, parts, powers, and affections of the same. The other is pathological, which unfolds the diseases which affect it, a translation of *De anima brutorum*” (1672), English trans. S. Pordage (London: Dring, Harper and Leigh, 1683), 33.

²⁹ Abraham Gaultier, *Parité de la vie et de la mort. La Réponse du médecin Gaultier (1714)*, ed. O. Bloch (Paris: Universitas; Oxford, UK: Voltaire Foundation, 1993).

³⁰ Théophile Bordeu, “Recherches sur le tissu muqueux” (1767), §VII, in Bordeu, *Œuvres complètes*, 2 vols. (Paris: Caille et Ravier, 1818), II, 736.

³¹ Israel, *Radical Enlightenment*.

³² Charles T. Wolfe, ed., *Monsters and Philosophy* (London: Kings College Publications, 2005); and Justin E. H. Smith, ed., *The Problem of Animal Generation in Early Modern Philosophy* (Cambridge, UK: Cambridge University Press, 2006).

3. Diderot's Biological Project

Diderot's biological project is inseparable from claims that are not themselves restrictively biological; he is the proponent of a (programmatically) Spinozist biology. Diderot was not a physician like La Mettrie, or a 'working natural historian' like Buffon; but one of his first publications was the translation of Robert James's *Medicinal Dictionary* (1745), and in addition to his enormous activity as the chief editor of the *Encyclopédie* (which heavily features medical entries, sometimes with his editorial interventions), he was also a serious student of chemistry, including 'vital chemistry'.³³ And in the *Éléments de physiologie*, the manuscript on which he worked during the last two decades of his life, he asserts: "Pas de livres que je lise plus volontiers que les livres de médecine."³⁴ In fact, as its title indicates, this work is about the elements of *physiology* (understood in the broad sense as a study of living animals and humans, as notably opposed to anatomy). Rather than having a specifically medical or medico-philosophical focus, Diderot is concerned with 'natural history,' by which he means the study of the nature of life as a whole, including its ontological status (whereby natural history has a specifically materialist dimension³⁵).

The latter dimension is apparent when Diderot moves within one sentence, as in his speculative, experimental work the *Rêve de D'Alembert* (1769), from a statement of epigenesis in the restrictive sense, to claims such as "Do you see this egg? It is with this egg that we can overturn all schools of theology."³⁶ This idiosyncratic combination comes in different prose forms in Diderot: sometimes in enlightened commentaries on experimental science (*Pensées sur l'interprétation de la nature, Principes philosophiques sur la matière et le mouvement, Éléments de physiologie*), sometimes in more speculative forms, which are harder to categorize (particularly the *Lettre sur les aveugles* and *Le Rêve de D'Alembert*); the latter has been described as Diderot's 'science-fiction.' In both of these sorts of works, Diderot is haunted or rather fascinated by the nature of living beings—their capacity to transform, to produce monsters, to return to life when the substance appeared dead, in short, their "polypous"³⁷

³³ Diderot attended Guillaume-François Rouelle's chemistry lectures at the Jardin du Roi (now the Jardin des Plantes) between 1754 and 1757, and served as secretary during many of the lectures, taking notes and even preparing some of the lectures for Rouelle, which were first published as "Introduction à la chimie, manuscrit inédit de Diderot publié avec une notice sur les cours de Rouelle," ed. Charles Henry (Paris, 1887); now available as "Cours de chimie de Mr Rouelle," in Diderot, *Œuvres complètes*, eds. H. Dieckmann, J. Proust, and J. Varloot (Paris: Hermann, 1975–), vol. IX.

³⁴ Diderot, *Éléments de physiologie*, in *Œuvres complètes*, vol. XVII, 510.

³⁵ Charles T. Wolfe, "'Cabinet d'Histoire Naturelle,' or: The Interplay of Nature and Artifice in Diderot's Naturalism," *Perspectives on Science*, vol. 17, n° 1 (2009): 58–77.

³⁶ Diderot, *Œuvres complètes*, XVII, 103–104.

³⁷ See Jacques Proust, "Diderot et la philosophie du polype," *Revue des sciences humaines*, vol. 14, n° 182 (1981).

nature, in all its “vicissitudes” (a term Diderot uses in a deliberately Lucretian manner, throughout his work, to mean a kind of perpetual flux and transformation).

So on the one hand, Diderot's interactions with the life science of his time can be understood in a straightforward sense as the activity of an educated individual with a strong interest in the implications for philosophy and traditional knowledge overall of new discoveries or conceptual schema, whether from medicine (with implications for knowledge about behavior), biology (implications for questions of reproduction and identity), or natural history (implications for the status of species and evolution). But on the other hand, his articulation of all of these in a *materialist project* does not belong in or open onto an episode among others in the history of science. I shall try to make both of these aspects more clear by (i) situating Diderot's concern with ‘biological life’ in the context of the emergence of biology as a science, and then (ii) turning to what I term here his ‘Spinozist biology.’

3.1. Diderot's Biologism and the Emergence of ‘Biology’

In a dramatic section of his *Pensées sur l'interprétation de la nature* (1753–54), Diderot seems to announce, more directly than in his usual, more metaphorical style, the advent of something like *biology*:

We are on the verge of a great revolution in the sciences. Given the taste people seem to have for morals, *belles-lettres*, the history of nature and experimental physics, I dare say that before a hundred years, there will not be more than three great geometricians remaining in Europe. The science will stop short where the Bernoullis, the Eulers, the Maupertuis, the Clairaut, the Fontaines and the D'Alemberts will have left. . . . We will not go beyond.³⁸

This passage has rarely been commented on, and scholars who have done so tend to miss the radical dimension. Thus Paolo Casini only notices that Diderot is mistaken in his diagnosis of the situation of mathematics: “This was a rather curious reaction in a period when the best continental mathematicians were active in solving so many problems left open in the *Principia*.” Somewhat closer to the point (but only in part), Casini does add that “at this time the life sciences entered a period of rapid growth and needed a proper new method.”³⁹ Indeed, similar proclamations about the rise of life science *together* with a denial

³⁸ *Pensées sur l'interprétation de la nature*, §IV, in Diderot, *Œuvres complètes*, IX, 30–31.

³⁹ Paolo Casini, “Newton's ‘Principia’ and the Philosophers of the Enlightenment,” *Notes and Records of the Royal Society of London* 42:1 (1988), special issue on Newton's ‘Principia’ and Its Legacy, 44.

of the pertinence of the mechanical, physical, and mathematical sciences can be found elsewhere, including the central article of the *Encyclopédie*, entitled “Encyclopédie”: “There is a general trend in people’s minds towards natural history, anatomy, chemistry and experimental physics.”⁴⁰ Similarly, Buffon stated in the first volume of his *Histoire naturelle* that “mathematical truths are just abstractions of the mind, that are in no way real.”⁴¹

This is science, or programmatic science, although it is anti-mathematical (and to be clear, Buffon the translator of Stephen Hales’s *Vegetable Staticks* and Diderot the author of several essays on probabilities, were by no means mathematically ignorant). Another example would be the medical vitalist focus on properties of organs (or muscles, such as irritability) that cannot be grasped mathematically (or at least are the object of failed calculations by iatromathematical physicians such as Keill and Borelli); a medical thesis on irritability defended at Montpellier in 1776 by a certain Mr. ‘D.G.’ (who further research identifies as Jean Charles Marguerite Guillaume de Grimaud), discusses properties of muscles but also ‘animals’ such as the polyp—both in terms of their contractility—in order to prove that the “human machine,” the “most complicated machine in the universe,” is not reducible to the simple, atomic, intellectual objects of mathematics.⁴² But Diderot is neither a natural historian nor a professor of medicine. What is his relation then to these proclamations of the supremacy of the life sciences? Is he putting forth essayistic sketches of a proto-biology, or a philosophical materialism with a vital flavour, as indicated before? Let us consider each possibility in turn.

If we read Diderot as somehow an actor in the emergence of biology, 40-odd years before its official appearance (or an observer of this appearance, whether or not he was right in his predictions about geometry), the reader may object that this is anachronistic. Yet I do not think this is the real problem with such an identification. The standard view is that ‘biology’ as a term appears in the late 1790s,

⁴⁰ *Encyclopédie*, in Diderot, *Œuvres complètes*, VII, 185. Analogous passages can be found in Diderot’s letter to Voltaire of Feb. 19, 1758, and in Grimm’s *Correspondance littéraire*, June 1, 1765, vol. IV, 1, 649. The *Encyclopédie* article “Histoire naturelle,” which is primarily by Diderot with some excerpts of Buffon, contains a reflection on trends and “fashions in the sciences”; Diderot notes that the “taste for abstract and mechanical sciences” replaced the taste for the study of antiquity, and that the former taste was in turn replaced by the taste for “experimental science,” which itself is now losing ground to “natural history” (an umbrella term for life science partly interchangeable with ‘biology,’ as I discuss at greater length in “Cabinet d’Histoire Naturelle”). But given this *hauteur de vue*, Diderot acknowledges—unlike thinkers we might think of as ‘vitalists’ or ‘organicists’—that there is no reason why this biocentric focus might itself some day not be replaced by something else (“le règne de l’histoire naturelle aura-t-il aussi son terme ?”) (*Encyclopédie* VIII, 1765, 228b).

⁴¹ Georges-Louis-Marie-Leclerc de Buffon, “De la manière d’étudier l’Histoire Naturelle,” in *Histoire naturelle, générale et particulière*, vol. 1 (Paris: Imprimerie Royale, 1749), 53.

⁴² ‘D.G.’ (Jean-Charles-Marguerite-Guillaume de Grimaud), *Essai sur l’irritabilité* (Avignon, FR: Bonnet frères, 1776), 33, 35.

in works by Treviranus and Lamarck (roughly at the same time)⁴³; Lamarck planned for a long time to write a treatise entitled *Biologie, ou Considérations sur la nature, les facultés, les développements et l'origine des corps vivants* (in fact, some of the manuscript, dated 1800, survives, but it did not circulate; it was published for the first time in 1944).⁴⁴ Treviranus aimed not only to provide a precise compilation of the knowledge of his time, concerning the phenomena of life, but also a theoretical framework for this new scientific discipline he called biology, by combining philosophical and experimental analysis and information.⁴⁵ Less well known is that the term 'biology' occurs in the context of *Naturphilosophie*, in authors such as T. G. A. Roose, K. F. Burdach, and C. C. E. Schmid,⁴⁶ or that there is a good deal of terminological instability in the decades prior to 1800, whether it is the presence of *biologi* in Latin, but with a different meaning (scientists studying plants⁴⁷), or the presence of competitor terms such as 'zoonomia' or 'biogeography' well until the 1830s.

But all of this confusion or profusion—semantic, scientific, conceptual—does, however, reveal an increasing concern with an ontological domain (including in all its colorful, popular images: spontaneous generation, polyps, monsters, and so on); and Diderot is certainly part of this concern, and indeed an important actor in its dissemination,⁴⁸ including the transformations of what had been 'natural philosophy' and the role of the philosopher therein. However, this does not capture his real motivations: He is not seeking to be a more materialist version of a Treviranus or a *Naturphilosoph*. If we understood him thus,

⁴³ G. R. Treviranus, *Biologie oder Philosophie der lebenden Natur für Naturforscher und Aerzte*, 6 vols. (Göttingen, DE: J. F. Röwer, 1802–22); and J.-B. de Lamarck, *Hydrogologie, ou Recherches sur l'influence qu'ont les eaux sur la surface du globe terrestre* (Paris: Agasse & Maillard, 1801–02).

⁴⁴ Jean-Baptiste de Lamarck, "Biologie ou Considérations sur la nature, les facultés, les développements et l'origine des corps vivants," ed. P.-P. Grassé, *La Revue Scientifique* 82 (1944), 267–276.

⁴⁵ Elke Witt, "Die wechselnden Gewänder der Natur: Die Biologie nach Gottfried Reinhold Treviranus," in M. Kaasch, J. Kaasch, and N.A. Rupke, eds., *Physische Anthropologie—Biologie des Menschen* (Berlin: VWB-Verlag 2007), 177–186.

⁴⁶ T. G. A. Roose, *Grundzüge der Lehre von der Lebenskraft* (Braunschweig, DE: Christian Friedrich Thomas, 1797); C. C. E. Schmid, *Physiologie philosophisch bearbeitet*, 3 vols. (Jena, DE: Akademische Buchhandlung, 1798–1801); and K. F. Burdach, *Propädeutik zum Studium der gesammten Heilkunst* (Leipzig, DE: n.p., 1800). On the development of biology, including as a self-conscious discipline in these years (1795–1802), see the sources cited earlier: Barsanti; Caron; and McLaughlin. For the issue of 'before and after' the naming of 'biology,' see Charles Wolfe, "Why was there no controversy over Life in the Scientific Revolution?" in V. Boantz and M. Dascal, eds., *Controversies in the Scientific Revolution* (Amsterdam: John Benjamins, 2011), 187–219.

⁴⁷ Robert Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago: University of Chicago Press, 2002), 4n.

⁴⁸ Thus the *Encyclopédie* devotes much more room to the life sciences than any predecessor work does, as discussed by Claire Salomon-Bayet, *L'institution de la science et l'expérience du vivant: méthode et expérience à l'Académie Royale des Sciences, 1666–1793* (Paris: Flammarion, 1978).

we would be neglecting the ‘Spinozist’ dimension of his thought, which is both more speculative and more radical. I’ve already noted that Diderot’s interest (or even fascination) in the nature of living beings, *does not open onto biology as a (nascent) science*, and indeed, does not aim at this development. As can be seen in the article “Spinosiste” and the other texts cited later, Diderot is articulating a junction, a connection among traditional metaphysical considerations, experimental revelations on the nature of life, and a new kind of philosophical project that is neither presenting itself as the *foundation* of the study of the natural world nor as a friendly *ancillary* to such study.

3.2. Diderot’s Spinozist Biology

So what is Diderot’s Spinozist biology, or biologicistic Spinozism? It is positively articulated in two texts of a very different nature: his short article “Spinosiste” in the *Encyclopédie* (which is the most ‘academic’ presentation of the present theme, but also perhaps the most surprising) and a more speculative version of the same text, which we find in his ‘experimental’ work *Le Rêve de D’Alembert*; it is negatively or ‘discursively’ articulated in his polemic with Maupertuis, which occurs some 10–15 years earlier, but which I discuss last.⁴⁹

Here is the definition of a Spinozist given in the *Encyclopédie* (not to be confused with the long, more conventional entry on Spinoza, which is largely authored by the Abbé Yvon):

SPINOSIST, s. m. (*Gram.*): follower of the philosophy of Spinoza. One must not confuse the ancient *Spinosists* with the modern *Spinosists*. The general principle of the latter is that matter is sensitive; they demonstrate this by the development of the egg, an inert body which by the sole means [*instrument*] of graduated heat moves to the state of a sensing, living being, and by the growth of any animal which in its inception [*principe*] is merely a point, and through the nutritive assimilation of plants and—in one word—of all substances that serve the purpose of nutrition, becomes a great sensing and living body in a greater [*expanse of*] space. From this they conclude that only matter exists, and that it is sufficient to explain everything. For the rest, they follow ancient Spinosism in all of its consequences.⁵⁰

The juxtaposition (or articulation) is surprising: There are ancient and modern Spinozists, and what characterizes the latter is essentially their commitment to epigenesis. Now, Diderot was fascinated by “the development of the egg” and related biological phenomena throughout his work, and he relates these to more

⁴⁹ Wolfe, “Endowed molecules.”

⁵⁰ Diderot, “Spinosiste,” *Encyclopédie*, vol. XV, 474a.

metaphysical questions: the nature of matter, the possibility that all matter can sense (“is sensitive”), and the shift from a state of inertia to a state of sensibility, or from inert matter to sensing matter, as we see in the above passage and also in those from the *Rêve* that I quote below. I hope it is clear that Diderot sees this as an inseparable relation between empirical phenomena (e.g., “here are two quite common phenomena: . . . the development of the egg, this move from the state of inert matter to the state of sensing being . . . the return to life of some insects”⁵¹) and a materialist doctrine in which the innate ‘vitality’ of matter demonstrates, or should demonstrate, the vacuity of any purported distinction between matter and thought, or matter and life. This *vital* dimension of Diderot’s materialism is well known, along with the role played in his thought by the shifts—epistemological, experimental, and other—in the ‘proto-biology’ of his time.

But why present this claim in the article “Spinosiste”? In fact, very few commentators have asked *why* Diderot gives such an idiosyncratic definition of “modern Spinozism.” To be sure, his convictions regarding living matter (or all of matter inasmuch as it is potentially living and sensing) are tied to his admiration for the metaphysics of a single substance composed of an infinite number of modes (“There is only one substance in the universe,” he states in the *Rêve*⁵²). But nowhere does Spinoza seek to connect his metaphysics to the life sciences; even if the notion of the *conatus* was frequently taken up in the generations after him to mean something like a survival impulse in living beings, this was not what he meant at all.⁵³ One of the few writers who did address my question (Why should epigenesis be presented as the view of modern *Spinozists*?), Paul Vernière, invented a category meant to cover such cases: “neo-Spinozism” (which was partly controversial). He defined this as a form of holist materialism *founded on the life sciences* rather than on a priori metaphysical speculation: “The neo-Spinozists are not abstract speculators but *savants*; starting from precise experiments on embryogenesis and animal physiology, they claim to find in matter itself the laws governing the origin and development of life.”⁵⁴ The mystery surrounding the article

⁵¹ Diderot, “Observations sur Hemsterhuis,” in *Œuvres*, vol. 1: Philosophie, ed. L. Versini (Paris: Laffont-Bouquins, 1994), 708.

⁵² *Rêve*, in *Œuvres complètes*, XVII, 107.

⁵³ For an interesting way of reading Spinoza as a thinker of ‘Life,’ however, see Sylvain Zac, *L’idée de vie dans la philosophie de Spinoza* (Paris: PUF, 1963), esp. ch. IV (as indicated earlier, Hans Jonas’s essay “Spinoza and the Theory of Organism” is less useful here). For the repercussions of ‘Spinozism’ as heuristic but also polemical construct in Enlightenment medicine and biophilosophy (e.g., in Boerhaave), see Annie Ibrahim, “Sur le spinozisme dans les philosophies du vivant,” in *Spinoza au XVIIIe siècle*, ed. O. Bloch (Paris: Klincksieck, 1990), 121–132; and for a more measured historical assessment, see Giglioli, “Whatever happened to Francis Glisson?” 485–486.

⁵⁴ Vernière, *Spinoza et la pensée française avant la Révolution*, 2nd edition (Paris: PUF, [1954], 1982), 529; he also describes Diderot (and Maupertuis) as neo-Spinozists in an editorial note to his edition of Diderot, *Œuvres philosophiques* (Paris: Garnier, 1961), 229. For more extensive

“Spinosiste” would then be dispelled: to be a neo-Spinozist is to seek to rearticulate a new form of (metaphysical) monism that would be in closer agreement with scientific data. But there is something odd about this definition, perhaps oddly neat in its way of demarcating a new form of science-friendly philosophical practice. For Diderot is quite willing to take statements of epigenesis into new territories that are neither inductively nor otherwise experimentally founded.

We can see this most clearly in one of his masterpieces, the experimental philosophical dialogue entitled *Le Rêve de D'Alembert* (*D'Alembert's Dream*) written in 1769, one copy of which was given by Diderot to Catherine the Great as a present. It is composed of three dialogues, of which the first two concern us here: In the first, the character Diderot debates the character D'Alembert on the nature of matter, thought, and sensibility, and tries to convince the latter that all of these are really on a continuum. Shortly after D'Alembert has said to Diderot “you have something against the distinction between the two substances,” Diderot asks, rather rhetorically,

Do you see this egg? It is with this [egg] that we overturn all schools of theology and all the temples of the world. What is this egg? An unsensing mass prior to the introduction of the seed [*germe*]; and after the seed has been introduced, what is it then? An unsensing mass, for the seed itself is merely an inert, crude fluid. How will this mass move to another [level of] organization, to sensibility and life? By means of heat. What will heat produce therein? Movement.⁵⁵

A lot is happening in this passage. To claim that “it is with this [egg]” that “all schools of theology” can be overturned is obviously to step outside of the controlled, empirical claims of biological science. We could call this an ideological or polemical moment (precisely illustrating what we have come to call the Radical Enlightenment); it is also, of course, a step toward philosophical materialism. Furthermore, it is a step away from ‘factual’ claims about one system of generation (epigenesis) versus another (preformationism) toward a metaphysics of living matter: In this integrated, causally closed universe, which is composed of “only one substance,”⁵⁶ there is no particular demarcation between dead and living matter. And in case we still thought we were dealing with neo-Spinozism understood as a kind of scientifically grounded materialist metaphysics, Diderot happily states here and elsewhere that we are dealing with

discussions of Diderot's usage of Spinoza and Spinozism, see Alexandre Métraux, “Über Denis Diderots physiologisch interpretierten Spinoza,” *Studia Spinozana* n° 10 (1994), 121-134; and John Zammito, “Naturalizm XVIII Wieku. Spinozizm w Filozofii nauki Diderota i Herdera,” in *Rozum i świat: Herder i filozofia XVIII, XIX i XX wieku*, eds. Marion Heinz, Maciej Potepa, and Zbigniew Zwolin'ski (Warsaw: Genesis, 2004), 117-146.

⁵⁵ Diderot, *Œuvres complètes*, XVII, 103-104.

⁵⁶ *Rêve*, in Diderot, *Œuvres complètes*, XVII, 108.

conjectures, suppositions, thought experiments, and all sorts of imaginative, speculative constructs. Crucially—for this sets him apart from proponents of a 'metaphysics of life' like Glisson or, differently, Stahl⁵⁷—Diderot acknowledges that "the necessary connection in this shift [namely, from brute matter to thinking matter, or from matter to sensibility and thought, CW] escapes me."⁵⁸ As has frequently been noted, Diderot chooses to put forth some of his most original claims regarding matter, life, and sensibility in an experimental work that is neither a philosophical treatise nor an experimental scientific report.⁵⁹

In the second dialogue of the *Rêve*, the character Bordeu twice tells Mlle de Lespinasse, when she is puzzled by some of the speculation (or by biological discussion), to "do in thought (*par la pensée*, literally 'by thought') what Nature does sometimes" (XVII, 149). Here is a case in which she is reporting one of the hallucinatory 'rêveries' or divagations of the dreaming or somnolent D'Alembert, where Diderot is essentially reconstructing and expanding the theory of epigenesis so that it becomes a theory of living matter in general:

It is certain that contact between two living molecules is something different from the contiguity of two inert masses. . . . A thread made of pure gold. . . —a homogeneous network. Between its molecules, others interpose themselves and perhaps form another homogeneous network, a tissue of sensitive matter, a contact which absorbs active sensibility from here and latent sensibility from there and which communicates itself like motion, without including. . . that there must be some difference between the contact of two sensitive molecules and the contact of two molecules which are not, and this difference—what could it be? . . . a habitual action and reaction . . . and this action and this reaction with a unique character. . . . Everything concurs thus to produce a sort of unity which only exists in the animal. . . ."⁶⁰

⁵⁷ On Glisson, see Giglioli, "What Ever Happened to Francis Glisson?"; on Stahl as defending a form of vitalism, see Kevin (Ku-Ming) Chang, "From Vitalistic Cosmos to Materialistic World," in Lawrence M. Principe, ed., *Chymists and Chymistry. Studies in the History of Alchemy and Early Modern Chemistry* (Sagamore Beach: Watson Publishing International LLC, 2007), 215-225; on interrelations between and shifts from 'metaphysics of life' to 'biology,' see Charles Wolfe, "Why was there no controversy over Life in the Scientific Revolution?"

⁵⁸ *Réfutation d'Helvétius*, in Diderot, *Œuvres*, vol. 1, 798.

⁵⁹ Compare the attention to genre in Jean-Claude Bourdin, "Du Rêve de D'Alembert aux *Éléments de physiologie*. Discours scientifique et discours spéculatif dans *Le Rêve de D'Alembert*," *Recherches sur Diderot et sur l'Encyclopédie* 34 (2003): 45-69 with the more strictly 'scientific' focus in Duchesneau, "Diderot et la physiologie de la sensibilité," discussion in Wolfe, "Sensibility as vital force or as property of matter."

⁶⁰ Diderot, *Rêve de D'Alembert*, in *Œuvres complètes*, XVII, 119; translation (modified) from <http://records.viu.ca/~johnstoi/diderot/dalembertsdream.htm>.

It is not just that Diderot is describing the organizational, transformative potential of “contact” (which he elsewhere calls “continuity”) between two living molecules in metaphorical terms (“a thread made of pure gold”). More originally, he is engaging in a form of scientific speculation, as we can see with his appeals to chemical concepts (“action and reaction”), in order to do justice to an apparently holistic phenomenon (the “sort of unity which only exists in the animal”).

Diderot articulates a connection between Spinozism and epigenesis in two very different kinds of texts: an apparently academic, precise entry in the *Encyclopédie* that combines (or juxtaposes) these different dimensions in a surprising way, and a more speculative, experimental series of reflections in the *Rêve de D’Alembert*. But as I indicated, there is a third locus for this topic: his debate with Maupertuis a decade earlier regarding the basic units of living matter or vital *minima* (“molecules”) and what metaphysics is, or should be implicit therein. Some ramifications of Spinozism as an item of or within natural philosophy (fleshing out the persona we encountered before of the ‘modern Spinosist’ described in the *Encyclopédie*) can be found in this debate, which is both about the units of life and how these should be understood and justified metaphysically: a Leibnizian pan-psychist vision of molecules possessing intentional properties (Maupertuis), versus an emergentist, organizational vision in which these properties are only the properties of the *Whole*, not of the elements. Put differently, the Maupertuis-Diderot debate concerning the nature of what they termed ‘molecule’ is in fact a debate over attribution of properties: Should these be applied to the element or the organizational whole? On the surface, this exchange or polemic is also a case of the two authors trading accusations of atheism and Spinozism with each other (for the definition of matter as possessing dynamic, organizational, indeed ‘intellective’ properties is of course a dangerous one). I briefly reconstruct the debate as regards the present topic.

In 1751, Maupertuis had published (supposedly in Erlangen, but actually in Berlin) a Latin treatise entitled *Dissertatio inauguralis metaphysica de universali naturae systemate*, under the pseudonym Dr, Baumann, which he translated into French in 1754 and published with a more specifically ‘biological’ title: *Essai sur la formation des corps organisés*.⁶¹ Diderot critically discussed the ‘Erlangen dissertation’ (and outed its author) in the second edition of his *Pensées sur l’interprétation de la nature* in 1754 (the first edition had appeared one year earlier), in sections L–LI. Maupertuis replied to Diderot’s criticisms in a *Réponse*

⁶¹ The final version of the text appeared in French with a title closer to the original, *Système de la nature*, in the 1756 edition of Maupertuis’s *Œuvres*. Marx Wartofsky’s 1952 paper is still one of the best commentaries on the topic (“Diderot and the Development of Materialist Monism,” *Diderot Studies* n° 2 (1952): 279–329, later reprinted in his *Models. Representation and the Scientific Understanding*, *Boston Studies in Philosophy of Science*, vol. 48 (Dordrecht, NL: Reidel, 1979), specifically 292–293).

aux objections de M. Diderot included in the third and final version of his essay in his 1756 *Œuvres*.

In section XIV of the *Essai*, Maupertuis asked his readers to imagine a molecule “endowed with desire, aversion and memory.”⁶² Diderot rejected the idea of endowed molecules, at least in the essential form as stated by Maupertuis. In order to challenge Maupertuis's hypothesis, which he accepts at the level of its “empirical” benefits but not as an overall “speculative” claim, he seeks to push it as far as it can go, to its “terrible consequences.”⁶³ (Maupertuis responded that if one were not already convinced of the sincerity of Diderot's religious beliefs, one might suspect that his intention is not so much to overturn his own theory as to “himself draw these consequences he calls *terrible* from it.”⁶⁴) Diderot felt that Maupertuis's molecules seemed to have been spiritualized, whereas he, Diderot, wanted to materialize the realm of the spiritual (i.e., the mental): First, and epigenetically, there is matter and motion, and gradually, through corpuscular arrangements of increasing complexity—which he terms “organization”—the phenomena or rather faculties of desire, aversion, memory, etc., are added on. Now, this seems rather mechanistic in contrast to Maupertuis; and indeed at this point, Diderot introduced the “dull sensitivity” (*sensibilité sourde*) by means of which all molecules have their place or fit into place (recall the “latent sensibility” of the molecules in the *Rêve de D'Alembert*). To be precise, Diderot allows for two properties: this rudimentary form of sensitivity, and an “automatic restlessness” (*inquiétude automate*) that leads the molecules into a variety of possible locations.⁶⁵

The key component in Maupertuis's response to Diderot is a notion that is equally important in Diderot's own thought, that of the Whole (*le Tout*), which has explicit Spinozist overtones. In that sense, when the two authors accuse each other of being Spinozists, it is partly out of bad faith and polemical motivations, but also partly because two monistic visions of matter are at stake—and Diderot is trying to bring out the implicit radicalism of this vision, which Maupertuis wants to keep hidden, wearing the mask of the scientist. It is because both Maupertuis and Diderot are committed to a notion of the universe

⁶² “Système,” §XIV; the term ‘endowed’ appears in §§XXXI and LXVI. At the end of the book, Maupertuis speaks of “originarily endowed elements” (§LIV, 173). The “Système” and the “Réponse” are in vol. 2 of the *Œuvres*; cited as “Système” followed by section number (in Roman numerals), and “Réponse,” followed by page number.

⁶³ From the outset (*Pensées sur l'interprétation de la nature*, §L, in Diderot, *Œuvres complètes*, IX, 77), Diderot had declared that he intended to push Maupertuis's hypotheses to their ultimate...or absurd conclusion, in order, he claims somewhat deceptively, to unmask the “terrible consequences” of the Erlangen doctor's theory.

⁶⁴ Maupertuis, “Réponse,” 197.

⁶⁵ Diderot, *Pensées*, §LI, *Œuvres complètes*, IX, 84.

as a substantial Whole that they are ‘neo-Spinozists’ in a broad sense, to use Vernière’s term—in addition to the specific, idiosyncratic sense manifest (e.g., in the article “Spinoziste”) as a proponent of epigenesis who is also committed to substance metaphysics.

Yet as I indicated before, we have to be cautious in endorsing Vernière’s concept with respect to both Maupertuis *and* Diderot, because he insists that what differentiates *neo*-Spinozists from Spinozists *tout court* is that the former base their reflections on scientific experiment and induction. This certainly does not apply to the—productive?—speculations in the *Rêve de D’Alembert*. Neither in that text, nor in the *Lettre sur les aveugles*, nor even in the *Éléments de physiologie*, does Diderot reason in strictly a posteriori ‘empirical’ terms, moving from facts to inductive generalizations. (One need only compare Diderot to Haller, whose physiological works he read very closely: What distinguishes them is precisely the Spinozist/radical element.⁶⁶) In addition, the observations, practices, and experiments on which the epigenetic theory rests, in Diderot’s context, are, as Olivier Bloch observed, no less speculative than those invoked by preformationists or creationists.⁶⁷

To be fair, the figure of the modern Spinozist as an inventor of a new, more empiricist approach to transformations in the sciences can be found elsewhere in this cultural context in the eighteenth century—that is, it did not spring fully formed from Vernière’s imagination—for instance in the Abbé Lelarge de Lignac’s three-volume work against fatalism *Le témoignage du sens intime et de l’expérience opposé à la foi profane et ridicule des fatalistes modernes*. In this work, which appeared in 1760 (thus five years prior to the above *Encyclopédie* article), Lignac describes what he terms a “new Spinozism”:

Our Spinozists are quite subtle reasoners. They abandon the materialism of Locke and revise other points of the doctrine of this Englishman to which they are strongly attached. They mingle adroitly with those of our authors who... are drunk with the purported beauty of Locke’s Metaphysics and tend towards universal Spiritualism. Our scattered (*déliés*) Spinozists *completely give up on the method of reasoning by abstraction and consequently on Spinoza’s method*—they decline to recognise him as their master, and thus are always angry when they are called

⁶⁶ Namely, if Haller’s physiology contributed the idea of a combinatorial system composed of the structural elements of the organism, a system of functional vital properties expressed at various levels of organic integration, Diderot in contrast is either (a) just a commentator on such concepts, (b) a materialist philosopher seeking to accumulate information to support his general metaphysics, or (c), more creatively, a thinker whose reflections on sensibility and fibres, organs, brains, bodies and networks constitute a genuine expansion of vitalist life science, boosted by speculative claims.

⁶⁷ Bloch, cited in Bourdin, “*Du Rêve de D’Alembert aux Éléments de physiologie*,” 52–53.

Spinozists. But they claim to ground Spinoza's system in facts and deserve the glory of a second invention.⁶⁸

And there is plenty of reference to Spinoza and Spinozism in the life sciences in the period, usually in pejorative terms (just like the usage of those terms in philosophy), as in the accusation against Boerhaave that he was a Spinozist.⁶⁹ In addition, Vernière's category of neo-Spinozism is not so restrictive as to make its actors—here Maupertuis and Diderot—strictly a combination of Spinozism and Enlightenment life science; he also allows for the integration of Leibnizian components, which make much more sense of Diderot's way of understanding the self-organization of living matter, which at times takes the form of a “materialization of the monad.”⁷⁰ But at the level of a *framework*, Diderot chooses to call it Spinozist, and instead of disqualifying this automatically, we can also consider it either a kind of performative rather than textually strict Spinozism, or a more ‘constructivist,’ home-grown species of the theory, what Ann Thomson once called “Spinosism with an ‘s’ rather than a ‘z,’” referring to the spelling of Diderot's article.⁷¹ Unlike the more common case, when it is the danger of Spinozism that leads thinkers to invent new conceptual tools (from Cudworth and Goclenius to Kant and Fichte⁷²), here it is a positively endorsed form of Spinozism that is invented.

⁶⁸ Lelarge de Lignac, *Le témoignage du sens intime et de l'expérience opposé à la foi profane et ridicule des fatalistes modernes*, 3 vols. (Auxerre, FR: F. Fournier, 1760), vol. 1, 350–351, emphasis mine. Vernière notes (*ibid.*) that de Lignac was close to Réaumur and thus ‘up to date’ regarding biological research and the sorts of ideological claims relating to such research.

⁶⁹ The story of how Boerhaave was accused of Spinozism is well known and can be traced back to his funeral oration (I thank Theo Verbeek for this point). Haller speaks of Boerhaave's “carelessness,” which led him, in an encounter with a cleric who was attacking Spinoza, to “defend the atheist and hurt the Christian” (letter to Rast of June 5, 1777, in *Correspondance inédite de Albert de Haller, Barthez, Tronchin, Tissot avec le Dr. Rast, de Lyon*, ed. Dr. Vernay [Lyon, FR: Aimé Vingtrinier, 1856], 29). Boerhaave cited Spinoza in his *Praelectiones academicae*, ed. Haller, 3 vols. (Göttingen, DE: Anton Vandenhoeck, 1739), §§570, 578; and La Mettrie associates Boerhaave with Spinoza in his *Abrégé des systèmes, Œuvres philosophiques*, ed. F. Markovits (Paris: Fayard, 1987), I, 267. In a strictly medical context, Boissier de Sauvages remarks that mental illness is not always “a bodily flaw, as Boerhaave implies and the Spinozists assert”; *Nosologie méthodique*, 10 vols. (Lyon, FR: Bruyset, 1772), VII, 19.

⁷⁰ See, e.g., the way Diderot moves from the conatus to the Leibnizian *nisus*, in his consideration of atoms in the article “Hobbisme” (*Encyclopédie* VIII, 235).

⁷¹ Ann Thomson, “Les Lumières radicales sont-elles panthéistes?” in *Qu'est-ce que les Lumières 'radicales'? Libertinage, athéisme et spinozisme dans le tournant philosophique de l'âge classique*, eds. C. Secrétan, T. Dagron, and L. Bove (Paris: Éditions Amsterdam, 2007), 258. On the idea of an ‘invented Spinozism,’ see Yves Citton, *L'Envers de la liberté. L'invention d'un imaginaire spinoziste dans la France des Lumières* (Paris: Éditions Amsterdam, 2006).

⁷² For an interesting claim that German Idealist metaphysics (from Goclenius and Wolff to Fichte and Hegel) emerges specifically as a response to the danger of Spinozism, see Pierre-François

4. Conclusion: Spinozism and/as Epigenesis

Diderot's Spinozist biology and epigenesis as the moment of invention of vital materialism are located in an unusual conceptual space—neither a standard contribution to metaphysical or otherwise systematic discussion of Spinoza, nor a contribution to positive life science destined to become a chapter in a history-of-science survey. One could then imagine that he chooses to describe “modern Spinozists” as partisans of epigenesis in order to underscore the radicality of this biological theory, which, as we saw in *Le Rêve de D'Alembert*, “can overturn all schools of theology.” Spinozism as epigenesis is not, then, a contribution to positive life science, yet we should not lose sight of the characteristic biologism of the concept, noticeable for instance in its anti-mathematicism. That is, partly like the polyp, monsters, and spontaneous generation, epigenesis belongs to a kind of “folk biology” that cannot be properly subsumed by the history of biology as a science. And yet, without reverting to the positivistic overtones of Vernière's conception in which Diderot's Spinozism is “in agreement with scientific data,” we might concede that modern Spinozists of this sort seek to reconstruct a metaphysics on physiological bases, as Alexandre Métraux has suggested,⁷³ but not as inductive generalization.

If, contrary to earlier readings fixated on the ‘myth of the precursor,’ Diderot belongs neither to the history of biology nor to its prehistory,⁷⁴ the question remains: How should one account for his complex relation to science, especially life science, which is neither metaphysically grounded (like Descartes's *arbor scientiae*) nor a strictly inductive project (like Bacon's tables of experiment)? Not only does his Spinozist biology not fit in the narratives proposed by either the history of biology or (internalist) history of philosophy; it furthermore also weakens the basis on which some ideologically motivated historians of materialism claim that philosophical materialism is the ‘handmaiden’ of the natural

Moreau, “Wolff et Goclenius,” *Archives de philosophie*, vol. 65, n° 1 (2002): 7–14. On the English context, see Rosalie Colie, “Spinoza and the Early English Deists,” *Journal of the History of Ideas*, vol. 20, n° 1 (1959): 23–46.

⁷³ Alexandre Métraux, “Über Denis Diderots physiologisch interpretierten Spinoza,” 131.

⁷⁴ For an early attempt to present “Diderot's biology” (not Diderot as ‘precursor of Darwin,’ but as a biologist), see Ferdinand Paitre, *Diderot biologiste* (1904; reprint, Geneva, CH: Slatkine, 1971): “Le plus glorieux titre de Diderot à l'admiration de l'historien, c'est... d'avoir été le premier transformiste” (89). For an attempt (of the sort made more brilliantly by Canguilhem) to explain why it is wrong to present Diderot as an evolutionist or transformist (or a precursor thereof), see Lester G. Crocker, “Diderot and 18th-Century French Transformism,” in *Forerunners of Darwin, 1745–1859*, eds. B. Glass, O. Temkin, and W. L. Straus (Baltimore, MD: Johns Hopkins University Press, 1959).

sciences.⁷⁵ As Olivier Bloch put it, science is not “the laboratory of materialism,”⁷⁶ or if it is, it is so in a very pluralistic sense.

Diderot's presentation of “modern Spinozism” as epigenesis plus “ancient Spinozism,” then, is (i) a serious engagement with the life sciences in flux in the mid-eighteenth century (and an anti-mathematical one); (ii) a metaphysical project in which natural history and physiology are in the service of materialism (but a vital materialism of active, self-transforming matter); and (iii) a speculative project (with a ‘radical’ dimension) that as such does not belong to the history of science and cannot be subsumed within it.

Acknowledgment

An earlier version of this chapter was presented at the Early Modern Medicine and Natural Philosophy Conference, Center for Philosophy of Science, University of Pittsburgh, in November 2012. I am grateful to the participants for their comments.

⁷⁵ A recent reiteration of the old—inseparably Marxist and positivist—view in which materialism and science are allies supporting each other's struggles is P. Charbonnat, *Histoire des philosophies matérialistes* (Paris: Syllepse, 2007); for some critical commentary, see M. Aury, C.T. Wolfe, “Sommes-nous les héritiers des Lumières matérialistes?” *Phares* 8 (2008): 11–33; also online at <http://www.ulaval.ca/phares/vol8-08/texte02.html>.

⁷⁶ Olivier Bloch, “Poursuivre l'histoire du matérialisme,” in *Matière à histoires* (Paris: Vrin, 1998), 459.