

# On the Vitality of Vitalism

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**M**ANY OF those who share an interest in the life sciences today, perhaps most, would agree with the claim that vitalism is obsolete. Some prominent biologists now use ‘vitalism’ as a derogatory label associated with lack of intellectual rigour, anti-scientific attitudes, and superstition (see, e.g., Dawkins, 1988). Other scientific commentators treat the term more seriously, but equally arrive at the conclusion that vitalism is an untenable perspective. Prigogine and Stengers (1984), for example, have described vitalist concepts as meaningful for biology within the broader scientific context characterized by Newtonian physics, but as having been made redundant by 20th-century developments both in physics and in (molecular) biology.

The claim that vitalism is obsolete – the ease with which this proposition is apparently accepted – might serve as a useful way of approaching the particular status of this concept in the work of Georges Canguilhem. The link is pertinent at different levels, in different ways. First of all, there is the point that Canguilhem addresses vitalism precisely in so far as it is constantly refuted, constantly declared ‘obsolete’ – a point to which I shall return in more detail below. Second, there is a question of the extent to which Canguilhem’s own propositions may be ‘obsolete’, on account of their vitalism.

This second question seems to be a concern in several commentaries that offer positive appreciations of Canguilhem’s life and work, but that also seem to share an intent to qualify and circumscribe the vitalist aspect of his thought. Dominique Lecourt, for example, exposes the ‘misadventures’ of Canguilhem’s vitalism in so far as it relies on a notion of biological individuality that has been exploded by the development of molecular biology since the 1950s. According to Lecourt, while Canguilhem rightly highlighted the need to understand and preserve vitalism as a meaningful intellectual and ethical demand rather than a positive philosophy of life, this did not prevent him from attaching a substantialist and anthropocentric

ontology to the term. For this reason, Lecourt suggests that ‘perhaps we should abandon the word “vitalism”, given that it is so ambiguous’ (1998: 223). In the same collection, Nikolas Rose points to the languages of ‘genetic evolutionism, molecular biology, biomedicine and biotechnology, their new institutional sites . . . and their new techniques’ as new formulations of the problem of life that question fundamentally the organic image that underlies the notion of a vital normativity described by Canguilhem. It is clear, Rose writes, ‘that normativity no longer can be understood in terms of the self-regulation of a vital order – if it ever was. Normativity now becomes a matter of normality, of social and moral judgments about whether particular lives are worth living’ (1998: 165). As a result, Rose too proposes that ‘the productivity of Canguilhem’s reflections on norms in life lies less in his insistence on the vitality of life than on the light that it sheds on the character of those other norms that traverse our culture’ (1998: 164).

Judging by these texts, Canguilhem’s vitalism can and should be isolated as a mere aspect of his thought, and not necessarily the most relevant or defensible. The suggestion is that we should read his work despite, and not because of, its vitalism. It is against this background, and against this closure, that I believe it is necessary to pose anew some basic questions of clarification. These basic questions include: What sort of vitalism is Canguilhem’s vitalism? Is it justified to suggest that this form of vitalism is obsolete? What is the ambiguity of ‘vitalism’, and should the term be abandoned on its account?

### **I The Vitality of Vitalism: Two Meanings**

The term ‘vitalism’ is most readily associated with a series of debates among 18th- and 19th-century biologists, and broadly with the claim that the explanation of living phenomena is not compatible with, or is not exhausted by, the principles of basic sciences like physics and chemistry (see Benton, 1974; Lenoir, 1982; Cimino, 1993). However, scientists and philosophers have continued to address vitalism – if mostly in order to reject it – well into the second half of the 20th century, in connection with classic concepts such as mechanism and reductionism, but also in connection with the concepts of emergence, complexity, artificial intelligence, and with approaches such as information theory and cybernetics (see Carlo, 1966; Hein, 1968a, 1968b, 1969; Ackermann, 1969; Bronowski, 1970; Hoyningen-Huene and Wuketits, 1989; Rapaport, 1995; Emmeche et al., 1997).

Not many authors acknowledge the semantic polyvalence of vitalism, and it is commonly assumed that vitalism necessarily involves some reference to metaphysical principles, some degree of teleological thinking, and the opposition to mechanism. While these features do apply to some vitalists, Benton (1974) has shown that they represent a gross simplification and misrepresentation of the variety of meanings associated with the term.<sup>1</sup> For our purposes it will suffice to refer to the broad distinction proposed by Wuketits (1989) between ‘animist’ and ‘naturalistic’ varieties of vitalism, where the first is explicitly metaphysical and teleological in orientation,

while the second posits organic natural laws that transgress the range of physical explanations. Both varieties of vitalism are described by Wuketits – who speaks from the perspective of general systems theory – as ‘untenable in the light of modern biological research’.<sup>2</sup>

To understand the specific form of Canguilhem’s vitalism, we need not ignore this proposition of untenability. On the contrary, as I have already suggested, it is necessary to take it as a point of departure. Canguilhem proposes that we treat as significant the historical ‘vitality of vitalism’ – the fact that the imperative to refute vitalism has had to be continually reiterated up until the present. In so doing, he is also proposing that we revise the notion that what appears to be methodologically untenable from the perspective of contemporary science may be ignored or dismissed as obsolete. The imperative to refute vitalism, in a sense, is superseded by the need to account for its permanent recurrence. The question of vitalism acquires a new dimension – a diachronic dimension – that supplements and subverts each one of its settlements.

The theme of the ‘vitality of vitalism’, therefore, can be read in the first instance as an answer to the epistemological problem of assessing the value of episodes in the history of science, when this problem is posed specifically in the context of the life sciences.<sup>3</sup> As the negative term of reference against which biological thought and techniques have progressed, vitalism represents a significant motor force in the history of biology (Canguilhem, 1975: 84). It is the trope through which, and in answer to which, the life sciences have come to constitute their own specific domain distinct from those of physics and chemistry. It is an error, but an error endowed with a positive, perhaps even necessary, function. As Michel Foucault put it in his introduction to *The Normal and the Pathological*:

if the ‘scientificization’ process is done by bringing to light physical and chemical mechanisms . . . it has on the other hand, been able to develop only insofar as the problem of the specificity of life and of the threshold it marks among all natural beings was continually thrown back as a challenge. This does not mean that ‘vitalism’ . . . is true. . . . It simply means that it has had and undoubtedly still has an essential role as an ‘indicator’ in the history of biology. (1989: 18)

These considerations account for a relationship that Canguilhem establishes with vitalism as an element in the history of science. Canguilhem endorses vitalism conditionally, in that the historicity of vitalism allows for a resignification of its value for the science of biology. In itself, however, this says little about the way in which we might qualify Canguilhem’s own thought as ‘vitalist’. For this we must focus on a further resignification, implicit in the first one, but this time concerning what questions we treat as relevant in relation to vitalism.

In *La Connaissance de la vie*, Canguilhem proposed that vitalism should be regarded as ‘an imperative rather than a method and more of an

ethical system, perhaps, than a theory' (1994: 288). Like the first one, this is a resignification that can only occur by evaluating vitalism diachronically, as a key element in an ongoing dialectical process. What is relevant about vitalist theories and concepts for Canguilhem is not what they *say* – and whether what they say is ultimately scientifically defensible – but rather what they *do*, by providing a form of resistance or antithesis to the recurrent possibility of reduction, and to the temptation of premature satisfaction. Canguilhem, who was in many ways critical of Bergson, would have agreed with his point that 'the "vital principle" might indeed not explain much, but it is at least a sort of label affixed to our ignorance, so as to remind us of this occasionally, while mechanism invites us to ignore that ignorance' (Bergson, 1911: 42).

Canguilhem is himself a vitalist to the extent that he invites us to recognize in the form taken by the history of the life sciences the characteristic trace, the specific response, of *life* as their object: '... transposing the dialectical process of thought [that alternates between vitalism and mechanism] into the real, we may say that it is the object of study itself, life, that is the dialectical essence; and that thought must espouse its structure' (1975: 85). Thus, while vitalist theories remain scientifically inadequate and philosophically naive, they are nevertheless directly *relevant* to the problem of life.<sup>4</sup> The oscillation that characterizes biological thought, of which the alternative between vitalism and mechanism is but one expression, is the symptom of a form of knowledge marked by a paradox: the science of life is, itself, a manifestation of the activity of the living, a manifestation of its own subject matter. Once it is understood performatively, as resistance and excess with respect to the remit of positive knowledge, vitalism therefore appears valid – not in the sense of a valid representation of life, but in the sense of a valid *representative*. In other words, and to reiterate: it is not as an account of life that vitalism appears viable; rather, it is as a symptom of the specificity of life that its recurrence should be understood. To erase the contradiction that vitalism provides, to dismiss it as a weakness of thought, is to silence life, and to become ignorant of ignorance.

The 'vitality of vitalism' thus can be read in a second sense as pointing, beyond a question of epistemology, to an ontology. It points not only to a dialectic movement internal to knowledge, but also to the movement that links knowledge with its condition of possibility, life. 'To understand the vitality of vitalism,' writes Canguilhem, 'means to engage in a search for the meaning of the relationship between life and science in general' (1975: 85). His vitalism is an assertion of the originality of life, understood also, and especially, in the sense of its logical priority with respect to knowledge: 'once we recognize the originality of life, we must "comprehend" matter within life and the science of matter, which is science *tout court*, within the activity of the living' (1975: 95). It is impossible, therefore, to confuse Canguilhem's position with the forms of what he calls 'classical vitalism' – whether these be animist or naturalistic, to return to the broad terms of Wuketit's typology. As Canguilhem explains, classical vitalism commits a

philosophically inexcusable mistake when it takes the ‘originality’ of life to mean that life constitutes an ‘exception’ to the laws of the physical *milieu*. Classical vitalism, in this sense, is a purely reactive form of thought: it implicitly acknowledges the logical priority, and the normativity, of the world described by the sciences of physics and chemistry. The originality of life cannot be claimed for a segment of reality, but only for reality as a whole. Biology must affirm its own ‘imperialism’ (1975: 95).<sup>5</sup>

To avoid the possibility of misunderstanding, Hertogh has proposed that we should call Canguilhem’s vitalism a ‘polemical vitalism’. ‘This notion of life’, Hertogh writes, ‘has a critical and no positive meaning’ (1987: 123). Like Lecourt, Hertogh seems prepared to accept the vitalism in Canguilhem, but only with the proviso of a strong qualification; the link with ontology in particular must be treated with suspicion. Yet, I want to suggest, it is possible to misunderstand Canguilhem in more than one way; that is, not only in the naive sense of failing to see the difference between his vitalism and classical forms of the idea, but also in the sense of failing to see a certain continuity between them, by underplaying the reference to the ontology of life and underestimating its significance.

## II Contexts of Relevance

In the remainder of this article I will approach this aspect of the question by relating Canguilhem’s vitalism to accounts of systems theory and complexity, provided by Franz Wuketits and Isabelle Stengers respectively. This (all too brief) comparison is intended as a programmatic invitation to seek a homologue to Canguilhem’s vitalism in contemporary forms of scientific thought, with which one might return to the question of whether this vitalism is ‘obsolete’. I might begin, therefore, by stressing that when Canguilhem advocates an ‘imperialism’ of biology, when he invites biologists to shed their modesty in order to universalize their conception of experience, he sees this position as being perfectly compatible with the tenets of contemporary physics. It is through relativity theory and quantum mechanics that, in the first instance, we have been obliged to reconceptualize the terms that link, or indeed define, the subject and the object of knowledge:

The environment [*milieu*] within which life is seen to appear only has the meaning of environment through the operation of the human living being, who performs measurements . . . that bear an essential relation to technical instruments and procedures. . . . [W]e have come to discover that, in order for there to be an environment, there must be a centre. What gives an environment the meaning of conditions of existence is the position of a living being, referring to the experience it lives in its totality. . . . Thus understood, a biological point of view on the totality of experience appears perfectly true [*honnête*] both to the man of knowledge, especially the physicist, and to man as a living being. (Canguilhem, 1975: 96)

Critics like Dominique Lecourt (1998) have taken issue with this proposition, suggesting that Canguilhem transfers his own concepts into a reading

of contemporary scientific developments, instead of letting these instruct his philosophy.<sup>6</sup> For Lecourt, it is impossible to ‘reconcile the primacy accorded to the relationship between terms with the idea that one of those terms, namely the living individual, constitutes an absolute centre of reference at every level’ (1998: 220). Lecourt claims that Canguilhem’s use of the category of ‘living individual’ is both anthropomorphic and anthropocentric, and he presents these as forms of self-contradiction and conceptual weakness. Is this actually the case? The question, I should stress, refers not to whether the text actually is anthropomorphic/centric, but to whether this constitutes a conceptual weakness, indeed the sure symptom that a text must be ‘obsolete’. I propose that it does not, and that to construe it as such is to miss the point of the epistemological shift that is being proposed.

In support of this view, it is possible to turn to Donna Haraway, who might well be described as one of the most authoritative voices in the contemporary debate on post-humanism. Haraway, like Lecourt, refers to contemporary biology to contest the notion that a stable ontological ground can be provided for the category of the ‘individual’. On the basis of an analysis of immunological discourse, she has famously argued that ‘[a]ny objects or persons can be reasonably thought of in terms of disassembly and reassembly: no “natural” architectures constrain system design’ (1991: 212). Equally interesting, but perhaps less often remembered, is how Haraway’s argument goes on to develop in the same paragraph. ‘Design’, she writes, ‘is none the less highly constrained. What counts as a “unit”, a one, is highly problematic, not a permanent given. Individuality is a strategic defense problem.’ What we have here is a notion that there is no *essential* stability or necessity – whether physical or logical – to the category of the individual. But, in the second part of the quotation, we also have the suggestion that categories of the individual, of the ‘unit’ or of the ‘one’, may well pertain to a different order of necessity – political, clearly; ethical, perhaps: ‘Individuality is a strategic defense problem.’

That this order of necessity might be described as a ‘vital’ order is indicated by the continued relevance of the notion of the individual in relation to the polarity between health and disease, or indeed life and death. As Haraway writes, in the conceptual vocabulary of the immunologists, ‘[p]athology results from a conflict of interests between the cellular and organismic units of selection’ (1991: 220), or again ‘[d]isease is a process of misrecognition or transgression of the boundaries of a strategic assemblage called self’ (1991: 212). Thus, to return to the point originally made by Lecourt, the fact that the individual, the organism, and indeed the human form, should be regarded as ontologically contingent, does not contradict the perspective (advocated by Canguilhem) that might place the living being at its centre. On the contrary, it is quintessentially an expression of such a perspective, in so far as a vitalist ontology cannot but be an ontology of the contingent, of what is permanently suspended between being and non-being. Canguilhem’s anthropocentrism, in this sense, represents the contrary of what anthropocentrism is usually taken to signify by its critics: rather than

affirming a right of supremacy, it suggests a kind of humility, an acknowledgment of (inevitable) partiality or, to use Canguilhem's own expression, a form of 'honesty' [*honnêteté*].

It is significant that Lecourt's critique, which is wielded in the name of contemporaneity as a whole, should take molecular biology as its norm. There is no doubt as to the empirical relevance of this norm. As Nikolas Rose has put it, in one respect

[T]o analyse what counts as true in life, we need to examine who has the power to define that truth, the contemporary role of different authorities of truth, the new epistemological, institutional and technical conditions for the production and circulation of truths and the ethical and political consequences of these truths. (1998: 168)

That the stakes are especially high in relation to molecular biology is, as I have mentioned, obvious in an empirical sense; the discourse of molecular biology is a powerful discourse, a discourse most visibly supported by the resources of power. The question is whether it is possible and desirable to treat this kind of empirical relevance as the norm for relevance *per se*.<sup>7</sup> Or, to turn this into a question: are there other vantage points, in the landscape of contemporary scientific knowledge, that might lead us to regard vitalism as a current form of thought? And can we justifiably ignore them?

One of the possible sources we might turn to, for the purposes of putting Canguilhem's vitalism through the test of contemporaneity, is the development of a systems-theoretical approach to the question of life, along the lines proposed by Paul A. Weiss (1969) and Ludwig von Bertalanffy (1968). Advocates of this approach, such as Franz Wuketits, set it explicitly against both mechanism and vitalism, suggesting that *both* positions can be guilty of relying on a metaphysical understanding of teleology. While this is explicitly the case in vitalist theories, where the specificity of life is addressed in terms of 'vital forces' or principles, mechanism tends to leave implicit the problem of teleology – which means that it remains possible, if inconsistent, to presuppose a metaphysical agency at the origin of life's organization.<sup>8</sup> Evelyn Fox Keller's excellent studies of the productive role of metaphor in the discourse of genetics amply illustrate this point. She explores, for example, how the construction of developmental explanation in genetic research has relied on semantic effects of ambiguity and polysemy in expressions such as 'gene action' and 'genetic programme'. As Keller argues in far more detail than I can reproduce here, each of these formulations allowed for a strategic 'blackboxing' of the problem of teleology at different points in the history of molecular biology (see Keller, 2001; also, less directly, 2000).

In contrast, according to Wuketits, the systems theoretical approach may be described as reinventing mechanism and vitalism by explicitly engaging with the problem of teleological organization, but only after emptying teleology of any reference to metaphysical principles, and to



human or superhuman agency. In this way, this approach claims to be able to address the specificity of living beings while meeting the requirements of scientific explanation. Wuketits, among others, suggests that this amounts to nothing less than the emergence of a new paradigm in biology and biophilosophy. It is a paradigm that involves an ‘organism-centred view of life’, where organisms are regarded as open, dynamic, homeostatic, and hierarchically organized systems characterized by fundamental and increasing complexity (Wuketits, 1989: 16–17; see also von Uexküll, 1997). It is a shift, one might add, that appears to parallel the development in the physico-chemical sciences of fields such as far-from-equilibrium thermodynamics and chaos theory.<sup>9</sup> Ironically, however, Wuketits proposes the term ‘holism’ to refer to this ‘organism-centred view of life’ – despite the fact that holism is itself a term that needs to be purged of metaphysical associations. This is interesting because it points to a difficulty that can no longer appear contingent but is intrinsic to the problem being addressed, and to the terms through which it comes to be addressed. Could systems theory provide the epistemological shift that Canguilhem advocated under the (similarly problematic) term ‘vitalism’? And why does it continue to seem necessary to employ these problematic terms, only to endlessly return to the task of having to qualify them?

These questions take us back to a point made earlier concerning the added value that identifying as a ‘vitalist’ affords besides, or even despite, the descriptive content of the word. In other words, they take us back to Bergson’s notion that ‘the “vital principle” . . . is at least a sort of label affixed to our ignorance’. And I propose that this point may be usefully expanded by relating vitalism to a concept that has come to play an increasingly important, if ambiguous, role in contemporary science, particularly within a systems-theoretical framework: the concept of complexity.

In a brilliant analysis, Isabelle Stengers invites us to distinguish the theme of complexity understood as the hallmark of a ‘new science’, or as the content of the latest scientific descriptions of the world, from the theme of complexity understood as an expression of what might be called a specific *ethos* or discipline of thought:

. . . if the theme of complexity is potentially *interesting*, and perhaps worthy of surviving compromising usage, it is . . . because it rekindles and highlights what is without doubt the most genuinely original aspect of what is called ‘modern science’. As Jean-Marc Lévy-Leblond reminds us, the function of scientific thought has less to do with its ‘truth’ than with its *astrigent effects*, the way it *stops thought from just turning in self-satisfying circles*. (Stengers, 1997: 5)

More specifically, the theme of complexity is meaningful in this sense when it intervenes to mark a leap in the order of possible knowledge, and therefore a difference in the quality of our ignorance, with respect to a specific instance or problem. To clarify this point, Stengers discusses the contrast



between the notions of complexity and complication. A phenomenon is *complicated* when the task of predicting its behaviour presents a difficulty due to incomplete information, or to insufficient precision in the formulation of questions, but when in principle it is possible to explain and understand it by *extending* a simple, fundamental model. In so far as the programme of molecular biology is reductionist, for example, it treats the reality of living beings as a tremendously complicated reality, but one that is nevertheless regarded as understandable, in principle, in terms of the model of a chain of physico-chemical determinations. For the situation of *complexity*, on the other hand, Stengers offers the examples of the behaviour of ‘strange attractors’ and of unstable dynamic systems. A complex situation is one where

the difficulty of an operation of passage [from the simple to the complex] may not be due to a lack of knowledge, an incomplete formulation of a problem, or the enormous complication of the phenomenon, but may reside in intrinsic reasons that no foreseeable progress could gainsay. (Stengers, 1997: 8–9)

In other words, the notion of complexity signals a break in the presumed continuity of different aspects of reality and of the laws that explain them. It signals that no single (or simple) set of questions may be treated as a generalizable norm, in terms of yielding relevant answers for all phenomena. And, last but not least, it applies to situations in relation to which the programme of reductionism, and the cognate aspiration to produce a form of knowledge that is exhaustive and deterministic, does not make sense.

Much more could be said about Stengers’s beautiful essay, but I shall limit myself to a number of brief points that will link it to the questions explored earlier in this article. In relation to the theme of vitalism, the notion of complexity is interesting, of course, in so far as complexity is ‘usually recognized as almost constitutive of the “living object”’ (1997: 13). The theme of complexity allows us to address living beings as original and singular, but not in the sense that their originality stems from an essential difference with respect to the physico-chemical world. Living beings are original and singular in the same way that any complex system is a singularity, on account of its distinctive temporality. Since complex objects, both living and non-living, do represent singularities, it is *both* possible to regard the living as a fundamentally natural object, equal in this sense to the objects of physics and chemistry, *and* impossible to simply extend physico-chemical models – including models of complex objects – to account for the living. For the same reason, living beings may justifiably be regarded as an ‘exception’ to the principles of physics if the principles we take as our norm are those of classical physics; on the other hand, they will appear as ‘normal’ singularities if the context of reference is that provided by the notion of complexity itself.

The point I wish to end on, however, concerns a further and more specific link between the notion of complexity and the vitality of vitalism. As we saw earlier, Stengers stresses that what is interesting about complexity is not the particularity of what may be described as complex, but what the notion

signifies at the level of conceptual effects. In this sense, the complexification of the world, or the vision of the world as complex, remains relatively uninteresting if it is treated as ‘paradigm’ that comes in to replace another, without affecting what is understood to be the ethos of scientific knowledge and its relation to the world.

Stengers’s emphasis suggests that the theme of complexity can be read as constituting an intellectual demand, an ethical imperative, that is not dissimilar to what Canguilhem addressed through the theme of the ‘vitality of vitalism’. Complexity expresses the demand that we acknowledge, and learn to value as the source of qualitatively new questions, the possibility of a form of ignorance that cannot simply be deferred to future knowledge. It is the demand that we acknowledge a sensitivity of the world to our interest in it, and to the forms in which this interest is expressed. This point might serve – in a programmatic way – as the informing principle for an analysis of the use of the term ‘complexity’ in the context of systems theoretical approaches in contemporary biology. It might offer clues for the purpose of deciphering the vital supplement that the term ‘holism’ provides, in the context of systems theory, to a notion of complexity that has begun to function as a normative operator, and possibly a source of theoretical self-evidence, in its own right.

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#### *Notes*

1. Benton’s piece includes a critical review of typologies previously offered by Kemeny, Toulmin and Goodfield, and Jørgensen.
2. See also Wuketits (1985). As Wuketits explains, ‘naturalistic vitalism’ is a different name for what Timothy Lenoir has called ‘vital materialism’.
3. As is well known, it was Gaston Bachelard who first spoke of a plurality of rationalisms corresponding to different regions of scientific practice (*rationalismes régionaux*). In line with this notion, Canguilhem argues that Bachelard’s method – and the rigid distinction it implies between positive and negative episodes in the history of science – are particularly suited to the scientific region in reference to which it was developed, namely, the region of mathematical physics and nuclear chemistry (see Canguilhem, 1988: 13). The degree of formalization evident in these sciences is such that the possibility of ambivalence appears relatively insignificant for the purpose of studying their history. It is from within this horizon that ‘sanctioned’ episodes look like positive contributions to progress, while ‘lapsed’ episodes look like epistemological debris that constitutes a wholly negative obstacle to the development of knowledge. As Gary Gutting (1989) has rightly observed, Canguilhem thus offers an implicit correction to the notion of ‘epistemological obstacle’ initially proposed by Bachelard. It is a correction very much in the spirit of Bachelard’s own work, that is to say, a specification of the conditions of relevance of Bachelard’s historical epistemology. For a fuller discussion of these themes, and for an application to the field of psychosomatic medicine, see Greco (2004a).

4. Here I am using the term ‘relevant’ in the sense discussed by Isabelle Stengers in the essay ‘Complexity: A Fad?’ (in Stengers, 1997). I shall come back to a discussion of Stengers later.
5. This proposition is strikingly close to the project developed by Alfred North Whitehead in *Science and the Modern World* (1925). In the reading offered by Isabelle Stengers (2002), Whitehead regarded the life sciences as having been ‘handicapped’ by their respect for physical explanation, or for ‘scientific materialism’. Whitehead’s project in *Science and the Modern World* was to centre the whole concept of the order of nature around the notion of the organism.
6. Lecourt refers in fact to developments in molecular biology, although he cites this text (Canguilhem, 1975: 95–6) to illustrate Canguilhem’s ‘anthropomorphism’ and ‘anthropocentrism’ (see below).
7. I have developed this critique more fully in an essay called ‘The Politics of Indeterminacy and the Right to Health’, see Greco (2004b).
8. On this point, see also Canguilhem’s essay ‘Machine and Organism’ (1992), where machines are (vitalistically) presented as an extension of the organic.
9. See Prigogine and Stengers (1984) for an accessible account of the emergence of a ‘science of complexity’.

### References

- Ackermann, R. (1969) ‘Mechanism, Methodology and Biological Theory’, *Synthese* 20: 219–29.
- Benton, E. (1974) ‘Vitalism in Nineteenth-Century Scientific Thought: A Typology and Reassessment’, *Studies in the History and Philosophy of Science* 5: 17–48.
- Bergson, H. (1911) *Creative Evolution*. Lanham, MD: University Press of America.
- Bertalanffy, L. von (1968) *General Systems Theory: Foundations, Development, Applications*. New York: Braziller.
- Bronowski, J. (1970) ‘New Concepts in the Evolution of Complexity’, *Synthese* 21: 228–46.
- Canguilhem, G. (1975) *La Connaissance de la vie*. Paris: Vrin.
- Canguilhem, G. (1988) *Ideology and Rationality in the History of the Life Sciences*. Cambridge, MA: MIT Press.
- Canguilhem, G. (1992) ‘Machine and Organism’, in J. Crary and S. Kwinter (eds) *Incorporations*. New York: Zone Books.
- Canguilhem, G. (1994) *A Vital Rationalist*. New York: Zone Books.
- Carlo, W.E. (1966) ‘Reductionism and Emergence: Mechanism and Vitalism Revisited’, *Proceedings and Addresses of the American Philosophical Association* 40: 94–103.
- Cimino, G. (1993) ‘Introduction: La Problématique du vitalisme’, *Biblioteca de Physis* 5: 7–18.
- Dawkins, R. (1988) *The Blind Watchmaker*. London: Penguin.
- Emmeche, C., S. Koppe and F. Stjernfelt (1997) ‘Explaining Emergence: Towards an Ontology of Levels’, *Journal for General Philosophy of Science* 28: 83–119.
- Foucault, M. (1989) ‘Introduction’, in G. Canguilhem *The Normal and the Pathological*. New York: Zone Books.
- Greco, M. (2004a) ‘The Ambivalence of Error: “Scientific Ideology” in the History

of the Life Sciences and Psychosomatic Medicine', *Social Science and Medicine* 53(4): 687–96.

Greco, M. (2004b) 'The Politics of Indeterminacy and the Right to Health', *Theory, Culture & Society* 21(5): 1–22.

Gutting, G. (1989) *Michel Foucault's Archaeology of Scientific Reason*. Cambridge: Cambridge University Press.

Haraway, D. (1991) *Simians, Cyborgs, and Women: The Reinvention of Nature*. London: Free Association Books.

Hein, H. (1968a) 'Mechanism and Vitalism as Metatheoretical Commitments', *Philosophical Forum* 1: 185–205.

Hein, H. (1968b) 'Mechanism, Vitalism and Biopoiesis', *Pacific Philosophical Forum* 6: 4–56.

Hein, H. (1969) 'Molecular Biology vs. Organicism: The Enduring Dispute between Mechanism and Vitalism', *Synthese* 20: 238–53.

Hertogh, C. (1987) 'Life and the Scientific Concept of Life', *Theoretical Medicine* 8: 117–26.

Hoyningen-Huene, P. and F.M. Wuketits (eds) (1989) *Reductionism and Systems Theory in the Life Sciences*. Dordrecht: Kluwer Academic Publishers.

Keller, E. Fox (2000) *The Century of the Gene*. Cambridge, MA: Harvard University Press.

Keller, E. Fox (2001) 'Genes and Developmental Narratives', paper presented at Goldsmiths College, University of London.

Lecourt, D. (1998) 'Georges Canguilhem and the Question of the Individual', *Economy and Society* 27: 217–24.

Lenoir, T. (1982) *The Strategy of Life: Teleology and Mechanics in Nineteenth Century German Biology*. Dordrecht: D. Reidel.

Prigogine, I. and I. Stengers (1984) *Order out of Chaos*. London: Flamingo.

Rapaport, A. (1995) 'The Vitalists' Last Stand', in R.M. Ford (ed.) *Android Epistemology*. Cambridge, MA: MIT Press.

Rose, N. (1998) 'Life, Reason and History: Reading Canguilhem Today', *Economy and Society* 27: 154–70.

Stengers, I. (1997) *Power and Invention*. Minneapolis: University of Minnesota Press.

Stengers, I. (2002) *Penser avec Whitehead: Une libre et sauvage création de concepts*. Paris: Seuil.

Uexküll, T. von (ed.) (1997) *Psychosomatic Medicine*. Munich: Urban & Schwarzenberg.

Weiss, P.A. (1969) 'The Living System: Determinism Stratified', *Studium Generale* 22: 361–400.

Whitehead, A.N. ([1925] 1985) *Science and the Modern World*. London: Free Association Books.

Wuketits, F.M. (1985) *Zustand und Bewußtsein: Leben als biophilosophische Synthese*. Hamburg: Hoffmann und Campe.

Wuketits, F.M. (1989) 'Organisms, Vital Forces, and Machines: Classical Controversies and the Contemporary Discussion "Holism" vs. "Reductionism"', in P. Hoyningen-Huene and F.M. Wuketits (eds) *Reductionism and Systems Theory in the Life Sciences*. Dordrecht: Kluwer Academic Publishers.

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